The FOUNDRY

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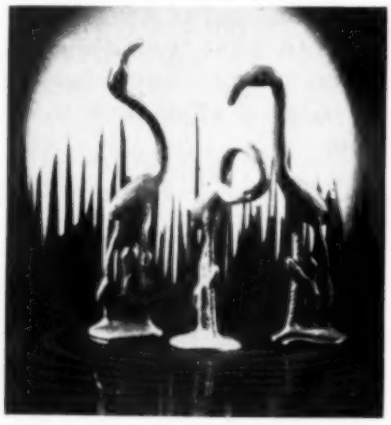
He Is Only a Snuffer with Few Pains in the Neck

DID you ever hear of a cigarette snuffer? THE FOUNDRY received one recently from the Lake City Malleable Co., Cleveland, as part of a well conceived and mighty interesting advertisement of certain properties of its malleable castings.



Accompanying the snuffer was a booklet containing a full reproduction of a photograph of three snuffers, shown in part in the accompanying illustration, and also the following message:

Nature Gave The Flamingo

a neck—more malleable than our best certified malleable iron, but did you know that malleable iron could be bent or twisted without fracture, as shown by the enclosed photograph? * * This illustrates in an artistic but graphic way why malleable iron has been used for many years in shock absorbers, bumper brackets and elsewhere in automobiles, trucks and railway cars. * * If you desire to try the malleable quality of these snuffers and bend or twist the neck too much, please send them back for immediate replacement. They may suggest to you how malleable iron would strengthen your own product and reduce costs.

What a lot of fun the recipients could have bending these flamingos' necks. Good demonstration of malleable qualities to the popular mind!

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Tap Unsuspected Casting Market

IN THE olden days the shop was conducted as a gray iron general jobbing foundry and in time it became one of the last survivors of the old school. It was built during a period when employes worked 12 hours a day and popularly were supposed to need neither light nor air. The roof beams were pust out of reach of a tall man and although the windows were high, they were neither wide nor handsome.

For many years this establishment was known among the molders—and others—of the city as the *Last Chance* foundry. Nothing but the direst necessity ever drove a man to work there. Even the hoboes avoided it until after they had made at least one, and in some instances several voyages around the entire list of foundries in the district.

Management and Plant Grow Old

The management was in keeping with the surroundings and both grew old together. Gradually they slowed down, little by little every succeeding year. Customers, tired of waiting, placed their orders elsewhere. Heats became smaller and farther apart. The bills payable became more insistent, while the bills receivable dwindled almost to the vanishing point. The windows became, if possible, more dingy than ever. Spiders undisturbed, spun their webs in front of the office safe and between the legs of the old-fashioned high stools. In a word and not to put too fine a point upon it, the business was shot.

It was another casualty, a shipwreck in the industrial sea, where so many trusting mariners discover too late that something more than faith, hope and charity and good intentions are required to keep afloat and to dodge modern competition.

Young Men Take Over Foundry

To pursue the simile a little farther, the derelict was salvaged by a couple of young men who had decided to take up the manufacture of malleable iron castings. They were long on optimism and other highly desirable characteristics, but not quite so well equipped financially. However, they decided that with the old plant as a nucleus they could knock together a temporary plant to serve until they were in a position to erect something really worth while.

They knocked out partitions, raised the roof, installed molding machines and a monorail system, built one melting and one annealing furnace and then made a bid for a share of the malleable casting business.

The beginning was slow and at times discour-

aging, a not at all unusual experience with industrial resurrectionists, but each year found the business a little better off than it was the year before. A little stronger, a little more robust, in a little better position to hold its own in an over populated and highly competitive field.

"Then," to quote one of these enterprising young men, "just as we began to see daylight and a possibility of easing up somewhat on the strenuous life, the bottom fell out of the stock market and all the money in the country went into hiding.

Customers Shop Around

"Individuals and companies tightened up the strings on the old weasel skin purse and only ordered the bare production necessities. The magnet of lower prices induced customers to shop around to some extent and add to the general state of demoralization. The question arose whether we should stand by the ship and take a chance of going down with her, or, take to the life boats while the taking was good."

"Truly a difficult decision to make. I take it you did not go down with her?"

"Go down? The past year has been the best we have experienced since we began business! We have revamped the old joint from the heels to the collar button and have four times the original crew working full time. At present we are faced with the necessity of increasing our melting and annealing facilities to meet current, and confidently anticipated, greater demand."

Thereby hangs a tale, rather unique in foundry annals. A tale which illustrates in a striking manner the difference between the new and the old technique. Details vary in individual cases, but they all hinge on a central essential feature.

Under former conditions the foundryman waited for the customer to place an order. He considered that any suggestion or advice on material, design or service, was outside his province. He filled the order, collected his bill and the incident was closed.

Under the new regime, the foundrymen study the needs of the customer, decide on the material and design best fitted to yield maximum service, then persuade the customer to place an order for this type of casting. Human nature being what it is, the satisfied customer becomes a steady customer and what is perhaps more important, he becomes a friendly booster. The intangible feature known as good will is an asset of tangible value difficult to estimate, but universally recognized. A satisfied casting customer is the same as any other satisfied customer and takes as much pride in referring to his favorite foundry as he does in referring to his favorite doctor or dentist or—if he is one of those who does not take the 18th amendment to the Constitution too seriously—his favorite bootlegger.

Think It Over

In the early scrambling days, the two young men did some intensive thinking in the few hours out of the 24 available for that purpose. Fortunately, they were not hampered by a heritage of tradition and custom and therefore were free to think along unorthodox as well as along orthodox lines.

"Coming right down to brass tacks," more of the same quotation, "we had to admit that the foundry capacity of this country, in every line, is too great and has been too great ever since the war days. The demand may and probably will catch up eventually, but in the meantime more work is needed if many existing plants are to be kept out of the hands of the devil—or his modern triple equivalent—the banker, the sheriff and the junkman. You probably have heard the story before.

"Of course the present depression is universal and by no means confined to the foundry industry and it is only natural to assume that as general conditions improve, foundry conditions will improve in proportion. A country

growing as fast as the United States, growing in wealth, in power, in producing capacity and the insatiable need of the inhabitants for more refinements, comfort and luxuries, a country of that kind, cannot long remain in the slough of despond.

"In fact it might not be out of place to refer to these periodical periods of depression as attacks of national indigestion. We gobble up more than we can take care of. Perhaps a more accurate comparison would be to that of a boa constrictor which gorges itself when it has the opportunity, then goes into retirement and does actually nothing until the process of digestion has been completed. Hunger once more is aroused and satiated and the cycle is repeated continuously throughout the period of a life time.

Provide Greater Outlets

"Following up the same simile, it is pertinent to point out that the human boa constrictor, the population of the country, continually is increasing and continually demanding new and more varied provender. All of which results in greater outlets for those who provide the provender, which includes everything from jewsharps to battleships."

Statistics compiled for 1929 indicate that the malleable foundry industry of the United States was operating at approximately 71 per cent of its capacity. In the first quarter of 1929 the average was 81 per cent. The second quarter showed a slight gain, the figure standing at 82 per cent. Then the demand began to taper off to 69 per cent in the third quarter and a drop to 54 per cent in the fourth quarter of that year. The average of 71.50 for the year was slightly higher than the average of 68 per cent given for the preceding year 1928.

The depression noted at the close of 1929 carried into the following year influenced, of course, by the falling off in production of the automotive industry. However, it is claimed that the curtailed automobile output has not reacted so unfavorably on the malleable iron industry as it has no other industries with which it is closely allied. According to figures compiled by the United States department of commerce based on reports submitted by 131 plants, the production of malleable iron castings has dropped steadily in the past year from 63.1 per cent of capacity in April to 26.2 per cent in September.

With a full knowledge of existing conditions, the two young men, singly and together, cast around for a satisfactory method of increasing their clientele. The two standard methods, one an offer of better castings and the other an offer of lower prices were picked up—figuratively—dusted off and examined and then reluctantly placed back in storage.

All this time the young men were making castings fully up to the standards adopted by the Malleable Iron Research Institute, an organization of which their company was a member. Manifestly, with a great number of malleable iron foundries, located strategically in relation to the market, and with each one producing castings of equal merit, any solicitation based merely on the ability to supply high class castings would not attract any alarming attention or carry much weight.

The temptation to cut under current quotations was dismissed as an entirely impractical solution of the problem. Even if the offer brought a few new accounts into the office, they would prove more of a liability than an asset. To keep in line with larger and better equipped foundries, the proprietors of the rejuvenated foundry had to adopt prices in which the margins were not any too fat. Further reduction would not provide a sufficient margin on which to operate. Also, if castings had to be given away, they preferred on general principles, that others rather than themselves should have that pleasure.

Arrived at this point in the meditation, or huddle, the original or main question invariably popped up, "Well, what are we going to do about it?"

Eventually the logical answer presented itself and was adopted with the result mentioned in the paragraph immediately following the inquiry of whether or not the ship had gone down with all hands.

Find New Markets

Briefly, the new plan was based on the broad general principle that each of the three ferrous metals, gray iron, malleable iron and steel, is better adapted than the remaining two for certain specific purposes. In many instances—owing to various reasons—the best metal for the purpose is not utilized.

Eventually it is quite probable that customers either in person or through their purchasing agents, will know all about castings and unerringly will select the metal best fitted to meet their particular requirements. In the meantime our young foundrymen decided to help the good work along and hasten the day of general knowledge, by an intensive analysis of the equipment methods of present and prospective customers.

The proposed campaign was altruistic to the extent that the customer was to benefit, although the primary purpose was to induce manufacturers in various lines and other handlers of metal parts to substitute malleable iron castings for the material which had heretofore been used.

"No use in being squeamish about it"—Interview still in progress—"All of 'em are doing it. Look at the propaganda put out by steel, gray iron and brass—well, maybe brass is an exception, but the brassmen will be the same as the others if they ever get organized and quit scrapping among themselves.

"In addition to the personal work of their salesmen, the gray iron interests, the steel founders, the structural men, the welders continually are presenting the merits of their materials, usually on a comparison basis with other materials. Sometimes the enthusiasm of the salesman is a more important factor than the merit of the material in consumating a sale. Time we had an adjustment all around with the right metal in the right place."

Expects To Stick Around

No one will quarrel with the statement that clever but faulty salesmanship is the worst kind of salesmanship. No permanent gain accrues to the foundryman unless the casting stays sold, or more properly speaking, unless both the buyer and the seller are satisfied with the sale. A foundryman is not a cheap jack, a mountebank, a seller of nostrums, or a gypsy, here today and gone tomorrow. He is a solid, substantial citizen with a stake in the community. He expects to stick around for quite some time and usually has hopes and aspirations running at least to one and perhaps three or four generations. He actually is interested in serving his customers to the best of his ability and naturally he expects to make a little money as he goes along.

Up to this point the theories and conclusions drawn therefrom presented no flaw. Only an actual application could prove whether the theory was based on a cold, solid foundation, or merely on the stuff of which dreams are made. The measure of success marking the campaign up to the present, seems to indicate that the foundation was even colder and solider than the builders imagined.

Let us descend from the realm of fancies and generalities and once more take up the thread of the interrupted interview.

"At the expense of considerable time and effort we compiled a list of 2000 prospective customers, manufacturers of articles in which castings formed, or might form one or more of the component parts. A circular letter was sent to each of the 2000, directing attention to (a) the many desirable features of malleable iron castings and (b) the advantage to be derived from substituting malleable iron for other materials in specific parts.

"We neither expected nor experienced a flood of orders on this in-

itial effort, but we had several inquiries and when these were followed up by a personal visit on the part of myself or my partner, several of the inquiries resulted in profitable business. In fact since the beginning of this specialized drive, one of us has been on the road almost continually, investigating prospective openings for malleable iron castings, explaining their advantages under specific conditions and taking orders. Yes, Sir! Taking orders in sufficient volume to warrant extension of our production facilities and an increase in our working force.

"In one instance an inventor came in here to have a few small parts cast. An examination of his machine showed that many welded steel parts could be replaced by malleable castings at a considerable reduction in manufacturing cost. Change and improvement in the design incident to the incorporation of castings, added greatly to the appearance of the completed machine. His business constantly is expanding and all his castings are made here.

Castings Are Too Good

"Our offer to supply special grates that would show three times the life of those now in use, attracted the attention of one man, but he at first balked at the idea of paying double the price of his former grates. We offered to install a set free on the understanding that if they failed, he would not have to pay for them.

"Life of the former grates was about one week. At the end of the third week the man sent a check and the announcement that the new grates apparently were as good as ever, but he wanted a new set on hand to replace the first bars when eventually they would have to be replaced. He is one of our greatest boosters and has sent a good bit of business down here. We find this attitude among practically all our customers. They want to pass the good word along to others.

"We found another company shipping its product in knocked down form to the West Coast where the finished article was assembled. Freight and breakage amounted to quite an item. Redesigned and cast in malleable iron, the freight bill was reduced by half and the breakage was eliminated entirely. Actual figures are not necessary, but for all present purposes it is sufficient to say that both we and the customer made money on the job."

"Summing up your experience, would you refer to any one feature or factor as the most important?"

"No, but I might refer to three: Know your own product. Bring its merits to the attention of prospective customers. Maintain quality."

Bulletin on Core Baking Is Available

The committee on industrial gas research, American Gas association, New York, has issued a bulletin giving information on core baking. The bulletin describes a specific case of the use of cores in the manufacture of bushings to illustrate their use in the foundry. The discussion also includes information on the requirements of cores, testing and the apparatus used, methods for heating core ovens, baking practice, and defects in casting caused by faulty cores. The material also includes a discussion of commercial core binders and a classification of core ovens. The booklet is well illustrated with reproduction from photographs showing the manufacture of many sized cores, various types of core ovens, and core testing apparatus. A chart giving the strength of cores baked at different temperatures also is included.

The bulletin was prepared under the direction of the American Gas association and is a compilation of data determined under a research problem carried out at the department of engineering research, University of Michigan, Ann Arbor, Mich. The work was done under the direction of H. L. Campbell, associate professor of metallurgical engineering, University of Michigan.

Safety Clamp Prevents Crucible Spills

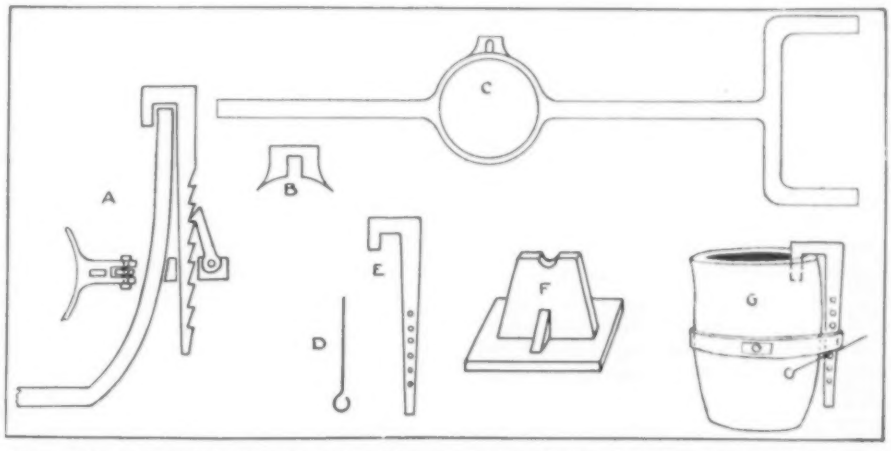
By W. G. Huard

Many years ago I first saw the device shown at G in the accompanying illustration. Recently its value was called to mind forcibly by an accident in a foundry where I worked. A crucible filled with molten metal and held in the shank in the usual manner without a safety catch, slipped from its place. The man standing in front, skimming, was burned severely about the feet and legs.

I have recommended this device in every foundry where I have been employed. Sometimes those who should have been interested, have scoffed at the suggestion. Sometimes the device has been promised consideration, and then forgotten.

In a large foundry in London, I saw it in constant use for nearly 7 years and no pouring from a crucible was allowed unless this device was attached safely. I can say honestly I saw no pouring trouble or accident during that time.

The ordinary shank easily can be equipped with this safety device. The boss *B* can be welded to any shank without causing the least inconvenience. The shank containing a crucible of metal is lifted on to the stands *F*. The hooked end of the bar E is placed over the top of the crucible and the lower end is dropped throught the slot *B* in the shank. The rod or pin *D* then is passed through the hole directly under the shank which so secures the crucible that there is no danger of a shift or capsize. The crucible then is skimmed and carried to the job.



Two Safety Crucible Devices Are Shown at A and G. One Employs a Pawl and Ratchet. The Other Uses a Pin Inserted Through a Hole in the Hook Bar Immediately Below the Shank

I do not know if I am all *behind* in submitting this device for consideration, but as I say I only have seen it used in one foundry. Up to the present I have not seen the safety catch shown at *A*, but I have been told that it is in use in some brass foundries in the United States.

Standard safety code B-8 of the American Standards association relating to the conditions in the foundry proper for the protection of workers making castings from iron, steel, aluminum, brass, bronze, etc., will be revised according to a recent report of the association. The chairman of the sectional committee is F. H. Elam, American Steel Foundries, Chicago. G. E. Bergstrom, National Founders association, Chicago, is secretary of the sectional committee.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

NOW that the American Foundrymen's association has a committee working on the nomenclature of foundry terms it is possible that new words will be invented and added to the language. In actual practice and among men actively engaged in the industry, the present terminology has served satisfactorily over a period of many years. The only occasions on which it has fallen down are those on which a man has attempted to convey a nice shade of meaning, or, where he has attempted to describe a method or process to a person in part or totally unfamiliar with the technique of the foundry industry.

For example on the subject of gating, the words gate, sprue, runner, head, riser, feeder, are applied in a dual sense. Any one may be used to describe part or all of the passage leading to or from a mold. The same word is applied with equal familiarity to the body of metal which eventually solidifies in this passage.

Changes Are Favored

Usage has sanctioned this practice and so far as available records show, no serious error ever has been perpetrated through a confusion of meaning. However, in the interest of clarity and for the particular benefit of the great number of men connected with the foundry industry, in other capacity than molders, this decision of the American Foundrymen's association to standardize and if necessary invent new terms, is highly commendable.

Setting aside the dual meaning of the various terms, the present discussion is concerned primarily with the openings or passages known under the generic name of gates and risers. The terms are applied loosely in many instances, but when necessity arises for accurate reference, the majority of foundrymen agree that the gate is that part of the passage opening immediately into the mold cavity. The runner is that part of the passage, usually located at the joint line of the mold, which supplies metal to the gate or gates, in the event that more than one gate opening is necessary. The sprue is the vertical passage from the top of the cope to the runner. If it is enlarged at the top to facilitate the reception of the metal, it still is known as the sprue. If an extension is added to the passage in the form of a receptacle to receive the metal from the spout of the ladle, it is known as the pouring basin.

Instances of exceptions to the foregoing classifications will flash into the minds of many readers. They will remember certain gates that cannot be divided into four parts. Also they may have had experience with gates made up of many more than four parts, but in a broad, general way the statement is correct. So far as possible—making due allowance for the exceptions that apply to practically every rule and description—the terms gate, runner, sprue and pouring basin, will be applied throughout this series in the manner outlined in this and a previous article.

Complexity and extent of the subject is indicated in Fig. 18, showing 32 main types of gates and risers. As with a pack of cards, the possible variations and combinations of these 32 are almost endless.

Application of various types, singly and in combination will be described later in this series. A brief description of the main types as shown in a series of simple sketches in Fig. 18 will serve as an introduction.

Branch gate is the term applied where two or more passages connect the runner with the mold cavity. Usually these passages are comparatively wide and shallow and are designed to conduct the metal rapidly and distribute it uniformly over a wide area in large, thin castings.

Gate Pours at Bottom

A bottom gate, as the name implies, is located at or near the bottom of the mold, where for any reason, the falling metal might disarrange the sand if introduced at the top. With the type of gate shown at *D* and *E* the force of the falling metal is checked at the bottom of the sprue where it takes a horizontal direction and enters the mold quietly. Thereafter the remainder of the metal rises gently until the mold is filled. The method has its advantages and disadvantages. Its principal disadvantages, in many instances, is that it interferes with the ideal process of metal solidification which should commence at the bottom of the casting and progress successively toward the top where the final shrinkage is compensated by liquid metal from the gate or risers. Where large risers or feeders are employed, the disadvantage of the bottom gate is not so apparent.

In many instances the total height, or other condition of the mold forces the adoption of the bottom gate. In other instances the shape of the casting, the variation in metal thickness, actually may require hotter metal at the bottom to equalize the cooling temperature throughout the mass. Chilled rolls furnish an example of

Explains Terms

UP TO the present, foundry nomenclature, including that applied to the subject of gates has not been characterized by the sharpness and clarity essential to the discussion of any subject. Even among men familiar with the technical and practical details of the foundry industry, the ambiguous use of terms pertaining to gating castings, frequently leads to confusion and to long and involved explanation. Each type of gate and each part of the passage through which the metal enters the mold, has a definite name. The accompanying description, illustrations and list of terms will be appreciated by all who are interested in accuracy of expression, either for their own information, or for the purpose of transmitting their information to others who are interested.

the first type of casting. Lathe beds with chilled ways are typical of the second.

A gate formed in a block of dried core sand is an improvement over a gate formed by the removal of a gate stick where a large volume of metal enters near the bottom of a green sand mold. In many instances the entire sprue and gate are formed in these blocks of sand. They are made in a convenient standard length and may be cut to suit special conditions. On standard jobs the gate corebox forms part of the pattern equipment and the finished cores are designed to fill a definite space.

Core Gates Used

Their use, of course, is not confined to green sand molding. To save time and insure a perfectly dry passage, core gates of various sizes and shapes are employed in dry sand and in loam molds. The type shown at *E* Fig. 18 usually is employed on large molds.

They do not function as dirt catchers, but by preserving their shape they do not add to the quantity of dirt—if any—which comes down with the metal. Any necessary remedial or rather preventative measure must be taken at the pouring basin.

The foundryman takes every reasonable precaution to prevent foreign material of any kind from entering the mold and usually has to battle at every stage of the metal's progress from the furnace to the mold cavity. Slag enters the ladle with the metal. Some of it floats on top and an additional amount rises to the surface while the ladle is at rest or in transit. This must be skimmed off. If the basin is not prepared properly, the rushing metal dislodges some of the sand and threatens to carry it into the sprue, thence to the gate and into the mold. To prevent this contingency the foundryman fixes a trap or dirt catcher at a convenient point between the pouring basin and the gate. Although it may take any one of various forms, it is essentially a bypass under an opening. On account of its lighter specific gravity, the foreign material floating on the metal rises in this opening and the clean metal flows beneath, into the mold. The method is not infallible, but usually is satisfactory.

Pouring metal through a double gate usually implies the use of two ladles at opposite sides or opposite ends of the mold. However, the term still is in the floating class and has not been pinned down definitely. It may refer with perfect propriety to a double passage leading to the mold and connected to a single runner. On many deep molds the vertical runner discharges metal into the mold through one gate at the bottom and another gate at or near the top.

Feed the Casting

The general term, feeder, is applied to any device employed to furnish additional metal to a casting after pouring has ceased. Every casting shrinks in volume as it passes from the liquid to the solid state, but in the majority of instances this shrinkage is uniform. Neither the inner structure nor the outer con-

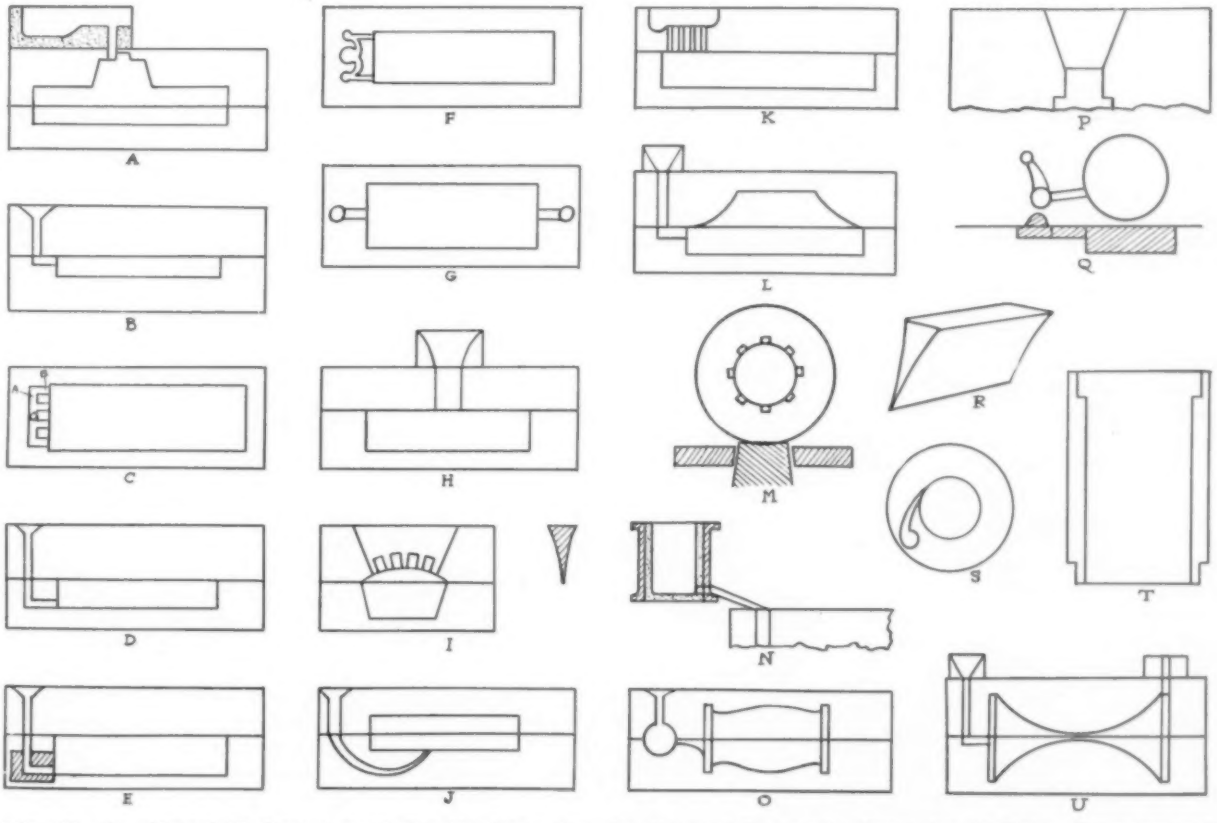


Fig. 18—*An Almost Endless Set of Combinations Can Be Evolved From the Examples of Gates, Runners and Risers Shown Here. The Names Applied To the Various Items Are Shown Below*

A—Pouring basin
A—Top gate
B—Single gate
Small gate
C—Branch gate
D—Bottom gate
D—In gate
E—Core gate
F—Skimmer gate
F—Set gate
G—Double gate
H—Riser
H—Head
H—Feeder
I—Finger gate
J—Horn gate
K—Strainer gate
K—Pencil gate
K—Pop gate
L—Large gate
M—Ring gate
N—Reservoir
O—Shrink bob
P—Sink head
Q—Storge gate
Q—Runner
Q—Dirt catcher
R—Wedge gate
S—Whirl gate
T—Tile
U—Pouring cup
U—Whistler

tour of the casting is affected. In some castings the outside shell freezes to a considerable thickness while the interior still is in a liquid condition. As a result, no metal is available to make up the discrepancy when the metal in the interior solidifies in smaller volume than it occupied in the liquid state.

A feeder also known as a riser, a sinkhead, or merely a head is placed on a mold of that kind to supply the additional metal required. The size and shape will vary according to local conditions. One of the common errors is to set up a feeder that is too small to be of any service, or a feeder that is large enough in the body, but in which the usefulness is nullified by a restricted neck. In either case the metal in the feeder or in the narrow neck, freezes before the metal freezes in the casting and as a result does not accomplish the purpose for which it was intended.

Pour Iron Rapidly

Finger gates I, Fig. 18 are employed extensively on thin castings, where, unless the metal is forced in rapidly, it will not reach the extremeties of the mold. The pattern for the finger gate is wedge shaped with the thin edge divided vertically for a distance of 1 or 2 inches into a number of small members, or fingers, hence the name.

In its general features it resembles the familiar wedge gate *R* employed in stove, hollow ware and sanitary casting plants. The only difference between the two types of gates is that the lower, narrow opening of the wedge gate is continuous, while the lower edge of the finger gate is not. The wedge gate delivers metal through one thin opening. Metal flows through the finger gate in several small, thin streams. The principal advantage of the finger gate over the regular wedge gate is that usually the metal remaining in the gate may be broken more readily from the casting. The piece of wood or metal designed to form the wedge or finger gate, is placed in an upright position on the pattern and sand is rammed around it in the ordinary process of forming the cope part of the mold. It is left in place until after the cope has been lifted off. Then the sand in the immediate vicinity of the sharp edge is slicked down with a tool for the double purpose of slightly increasing the thickness of metal in the casting at that point, and to slightly compress the sand along the edges of the gate so that it may withtsand better the force of the metal stream flowing through it. After the sand has been slicked, and in some instances dusted lightly with plumbago, the gate block is withdrawn from the cope.

Under certain conditions a horn gate *J* is the most satisfactory type for introducing metal to the mold. The pattern for a true horn gate is made to the arc of a circle and is tapered gradually from one end to the other. Thus after the cope has been removed from the drag, the pattern for the horn gate may be extracted from the drag. The horn gate forms a continuous curved passage from the joint line of the mold to any desired point in the bottom of the mold. It is a convenient form of gate to employ where the casting cannot be gated on the edge and where it is not advisable to pour iron down through a gate on the top. The horn gate introduces the iron quietly up through an opening in the bottom face of the mold.

Proper care must be observed in selecting the gate. If it is too small, the resulting casting may show cold shuts, missruns, or other indication of slow pouring. If the horn gate is too large, particularly at the outer end, the force of the stream may throw the metal up into the mold like a jet from a fountain. This is harmless on a wide, open surface, but it may create havoc on a bottom made up of comparatively fragile projecting bodies of green sand.

Owing to the almost unlimited range of sizes and shapes in the casting field, no sweeping rule can be laid down to govern the pouring speed. Slow pouring yields excellent results in some instances, as outlined in the first number of this series. Slow pouring applied to other castings, particularly light, thin castings, would produce nothing but scrap. Necessity has forced the foundryman to place such large gates and runners on these castings, that the metal which remains in them equals and in some instances outweighs the metal in the castings.

Figure the Loss

Probably a slight digression is in order here to dispose of a misunderstanding which seems to prevail to a certain extent. From time to time statements have appeared to the effect that in light and medium weight casting foundries, the recovery of good castings only amounts to 50 to 60 per cent. Men whose casting loss ranges between 3 and 5 per cent marvel at these figures and wonder how the 40 and 50 per cent foundries stay in business.

As with many other statements and terms used in the foundry, this 40 and 50 per cent statement is rather ambiguous. Literally, the meaning is that the weight of good castings only amounts to 50 or 60 per cent of the weight of metal charged into the cupola. For the time being the weight of iron remaining in gates and sprues, over iron, spills and scrap castings is ignored. The statement is general in character and is useful in checking the amount of iron which has to be melted to produce a definite tonnage of salable castings.

Weight of the various items which go to make up the discrepancy between the amount of iron charged into the cupola and the amount shipped as cleaned castings, varies according to the character of the work handled.

For example the cupola melting loss, that is the amount of iron actually destroyed, will vary from 1 per cent in the case of pig iron to approximately 10 per cent where light steel or iron scrap is melted. On plain simple castings, or even on more complicated castings where trained men are accustomed thoroughly to their production, the volume of scrap castings may be held down to 3 per cent, or less.

On certain classes of castings where the specifications are unusually rigid, the rejections may amount to 25 per cent of the total.

Analyze the Loss

Obviously the amount of iron which must be melted to fill the gates and runners, depends on the character of the castings. On certain classes of light bench and machine work, the amount of iron in the gates will exceed the amount in the castings. On exceedingly large heavy castings, the weight of iron in the gates and risers may not amount to 1 per cent of the total. On open sand castings the amount of iron left in the pouring basins usually is negligible.

A statement to the effect that a certain foundry only recovers 50 per cent in good castings, simply means that 5 per cent of the iron charged in the cupola is lost either up the stack or in the dump; 5 per cent is represented by defective castings which of course are not actually lost since they have a scrap value; 5 per cent of the total amount charged eventually is dumped in the pig bed, either as over iron from the ladles or the cupola. This metal is not lost, since it may be remelted. In extreme cases the iron in the gates, sprues and runners will amount to 25 per cent. These various items total 50 per cent of the amount of iron charged. That is what is meant by the statement that the recovery of good castings in light work foundries only amounts to 50 per cent.

From the foregoing it is apparent that the economic factor also must be considered in the design of gates and risers, both in regard to the size and shape, and the number placed on any given casting or group of castings. A possible saving of 5, 10, or 15 per cent on the daily melting cost is worthy of consideration.

This is the third of a series of articles dealing with the various types of gates and risers used in the foundry industry. The fourth will appear in an early issue.—The Editors.

What Will Prevent

BLOWS AND PIN HOLES?

By George Batty

ABILITY of a molding sand to produce casting free from blows and pin-hole penetration is not related strictly to its permeability, and many instances have come before the author's notice of high-permeability sands causing blows in castings. Highly permeable facing is most dangerous when it is backed by a close, relatively impermeable backing sand. A good principle to observe in the manufacture of green-sand castings is to ensure that the permeability of the backing sand is not less than that of the facing sand.

Moisture Promotes Defects

The moisture content of the sand near the face of the mold and the interparticle atmosphere of the sand may be considered as being in combination to promote defects in the steel casting. That statement is not made in any alarmist manner, but as a cold expression of fact. Blows and pin-holes are formed primarily as a result of the injection of gases from the mold into the casting. Investigations appear to indicate that the moisture content of the facing near the interface of mold and metal is the chief culprit in forming such defects.

When metal enters a mold, the moisture at the surface of the mold in contact with the metal is converted rapidly into steam and is driven bock from the face of the mold through the pores of the sand. In the same period in which such steam is generated, the interparticle atmosphere of the sand also is enlarged and the increased volume of atmosphere must readily migrate through the sand if excessive pressure within the mold is to be avoided. A coarse-grained sand has a large interparticle atmosphere, and unless the permeability of the whole of the mold is maintained there may be some injection of this expanded atmosphere into the casting at re-entrant angles.

A number of steel foundrymen have spoken of the ability of the sand to conduct away readily the enlarged atmosphere and the steam generated when metal is poured into the mold. Such an expression does not comprise the full facts. It is suggested that the behavior of the moisture near the face of the mold has not been understood.

The moisture near the face of a mold, when subjected to the thermal attack of the metal, is converted rapidly into steam. This steam, in a permeable mold, moves away from the mold face through the ducts or interparticle spaces in the sand. This steam almost immediately comes in contact with sand sufficiently cool to condense it and a film of condensate is formed approximately parallel to the face of the mold. As the heat from the metal penetrates the mold, the inner face of this film of condensate will rapidly be converted into steam. The condensate constitutes somewhat of a barrier in the mold and when part of the condensate is converted to steam, a belt of acute pressure is likely to be produced between the condensate and the face of the casting, because the permeability of the mold is depreciated locally by the condensate film.

If the permeability of the mold is unsatisfactory so that pressure is generated in the interparticle spaces to an extent greater than the tensile strength of the initially solidified envelop of the casting, the envelop or skin of the casting will be ruptured and gases injected into the casting from the mold. The belief that the moisture content of the sand must be maintained at the lowest practicable level, and that, wherever possible, green-sand molds should be allowed to air dry, is based on such an assumption.

The heat attack of the metal is much greater at a corner or angle of the mold and it is safe to assume that the generation of steam, and the expansion of interparticle atmosphere will be greater at that point. Since the facilities for escape of enlarged atmosphere are diminished at a corner or angle of a mold, it is at those locations that trouble from blows or pin-holes may be expected. The film of condensate receives at this place the most rapid and vigorous thermal attack of the metal. Thus, it seems reasonable to assume that, at any internal angle of the mold, the maximum of pressure will be generated as the condensate is reconverted to steam, because the conductivity of the mold for gas, water vapor or water is decreased at that particular location.

Work Not Dried

In snap work any appreciable degree of air drying is not practicable, but quite a large proportion of the work made in green-sand foundries may be given air drying over a period of 30 to 40 minutes which will, except in conditions of high humidity, reduce the moisture content at the mold faces from about 3.5 per cent to 2.4 per cent. The face of the mold, to a depth of ⅛ to ¼-inch, is the part that is primarily responsible for the troubles labeled blow and pin-holes, provided that the mold as a whole is uniformly permeable. A relatively impermeable sand may be made quite suitable to receive hot metal if it is skin dried, whereas a green mold must have considerably more satisfactory conditions as regards bond, silt, moisture content and true permeability if satisfactory castings are to be produced.

Density of the mold also is related to the formation of certain defects, because excessive ramming decreases the interparticle spaces and at the same time increases the concentration of moisture as related to volume, although not as related to mass. With decreased volume and a concentration of moisture, blow and pin-hole troubles are augmented. On machine production it is possible to allocate either a definite number of jolts or squeezes to any particular job, and there is no reason why the molders should not count the jolts to arrive more nearly at uniform ramming, when the machines are working efficiently.

Green-sand practice is not to be

Blames the Mold

WHAT happens when the molten metal enters a green sand mold? Does the moisture on the surface of the mold in contact with the metal move rapidly to the outside when it has been converted into steam, or will other conditions, outside of the permeability of the sand, influence the movement? The author, who is technical director, Steel Castings Development bureau, Philadelphia, has an interesting theory on the behavior of the steam as it moves through the sand. The article is abstracted from a paper presented at the Cleveland meeting of the American Foundrymen's association, May 12-16, 1930.

considered entirely as a method of producing castings at a cheaper rate than is possible when dried molds are used. It is absolutely essential to the satisfactory production of many types of castings that they be made in a mold which offers a minimum of resistance to the contraction of the casting during the change from solidification to shop temperature. Admittedly, many castings are knocked from flasks while their temperature is above 1000 degrees Fahr., but the bad effects of mold resistance to contraction of castings is generated in higher ranges of temperature below the freezing point of the metal.

Engineers and designers demand light and intricate castings as the most practicable means of securing the components they require. As these components must be free from defects, such as blows, pin-holes, cracks, tears or acute strains, it becomes essential that they be produced in green-sand molds. When the superficial area of a casting is large in relation to mass, the sections are light and hot metal must be used to produce those castings true to form. The pouring temperature of the metal must be higher than that for larger castings.

The influence of temperature upon those molding media which tend to produce gases when subjected to the heat attack of metal is a matter for serious consideration, and it would be unwise to assess the difference between 2900 and 2950 degrees Fahr. as a difference of 50 degrees in 2900 degrees. So far as the effect on the mold is concerned, we must remember that, when we compare the effect of hot metal and cool metal on a mold, we are dealing with liquid steel. Therefore, we should consider a difference of 50 degrees temperature in relation to the range of temperature for pouring.

The pouring temperature on large castings may not safely be below about 2700 degrees Fahr., and it is comparatively rare that the actual pouring of metal from handshanks or bull ladles is conducted at a temperature higher than 2950 degrees Fahr. A difference of 50 degrees in pouring temperature is quite a considerable proportion of the operative fluid range of steel for castings, and the question of sand control is tied in with the question of temperature control of metal. The design and nature of the casting may demand high temperature, and the sand must be adjusted and controlled to produce sound, satisfactory and dependable castings.

Determines Maximum Core Strength

By E. W. Beach

THE Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., recently conducted a series of experiments to determine the baking temperatures and time necessary to produce maximum strength cylinder block cores with the materials used in their foundry. Experiments were made on test bars which consisted of lake sand and linseed oil core binder in the ratio of one part oil to 60 parts sand by volume. The test bars were 1-inch square and 8 inches long. They were baked at temperatures varying from 300 to 450 degrees Fahr. for from 1 to 4 hours. After the baking operation, the bars were tested for transverse strength over two blunt-edged supports on 6-inch centers with the load applied midway between the supports.

Tests Sand Mixture

IN THIS article, which appeared recently in Industrial Ovens, the author gives data on the baking time and temperature for the development of maximum strength in oil sand mixtures for automotive cylinder cores. The author is an engineering executive for the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

It was evident from the data obtained that baking time exerted a considerable influence on the development of maximum core strength and that as the temperature rises, the time factor becomes relatively more important. The accompanying charts show the results of the tests. At 350 degrees Fahr., the greatest strength was obtained in 3 hours and practically none of the strength was lost after the cores had remained in the oven for an additional 2 hours.

At 400 degrees Fahr., the high point is obtained in 2 hours but the strength falls off appreciably if the core is allowed to remain in the oven an additonal two hours. At 450 degrees Fahr., the best strength attained was slightly better than 77 per cent of that possible in a 350 degree Fahr. bake and with 15 minutes additional baking that strength dropped about 6 pounds. Thus beyond the critical temperature, baking speed may be obtained only at the expense of core strength. The critical temperature for the type cores under investigation probably lies between 350 and 400 degrees Fahr.

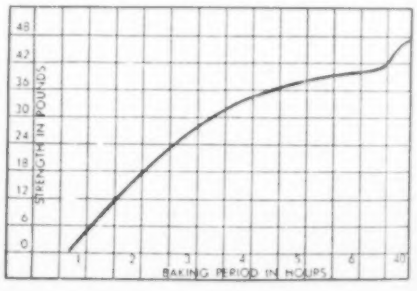


Fig. 1—Time Required to Attain Maximum Strength at 300 Degrees Fahr.

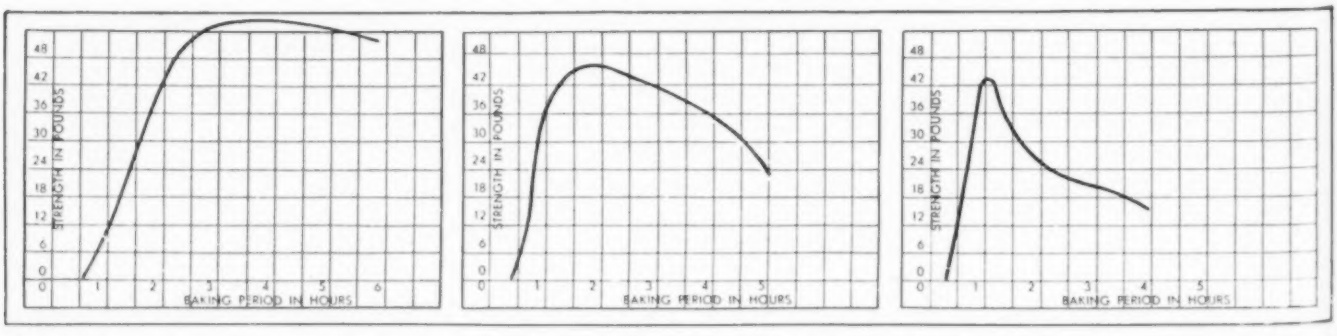


Fig. 2—Longer Time Is Required to Attain Maximum Strength at 350 Degrees Fahr. Fig. 3—Strength Is Sacrificed When Temperature Is Increased to 400 Degrees Fahr. Fig. 4—Maximum Strength Falls Off More as Temperature Is Increased to 450 Degrees Fahr.

Pours 500 Tons of Iron Daily Into Soil and Pressure PIPE

By Pat Dwyer

Fig. 1—Iron Is Distributed Rapidly from Multiple Lip Ladles Suspended from a Monorail

IN CONNECTION with a blast furnace, coke ovens and coal mines at Holt, Ala., the Central Foundry Co., with head office in New York and plants in various places, operates a large modern foundry devoted to the production of soil pipe, pressure pipe and fittings. Both soil and pressure pipe are molded and cast horizontally in green sand molds. The cores are formed in green sand swept on cast iron barrels. Molds and cores for the fittings also are made in green sand. Dry sand cores for bolt holes in the pressure pipe end lugs, for miscellaneous fittings and for pieces of shop equipment, are dried in a single small oven maintained for the purpose. The number of dry sand cores required in comparison to the casting tonnage is so light as to be almost negligible.

This foundry is essentially a green sand foundry where repetition castings in immense numbers are turned out to meet exacting specifications in size, weight, dimensions, shape and homogenity. Methods and equipment found efficacious in other plants of the company, have been adapted and in many instances improved in this, the most recent and greatest of the many foundries operated by the Central Foundry Co. With a melting capacity of 500 tons per day it is equalled by only a comparatively small number and outranked by only a few foundries of any kind in this country.

Factors responsible for selecting this particular site for a foundry

Fig. 2—A Constant Stream of Iron Flows from the Cupola Through a Skimmer Spout into a Reservoir Ladle and Thence To the Distributing Ladles

Fig. 3—Soil Pipe Castings Are Made Two in a Mold on Long Floors Containing from 70 To 80 Flasks

included the proximity of the blast furnace and the opportunity of developing and maintaining a permanent operating force. When running at capacity the foundry absorbs the entire output of the blast furnace. Instead of selling the pig iron in the open market, the company converts it into castings at a slight additional cost.

In addition to the group of foundry and auxiliary buildings, a town site was laid out and houses were erected for the employes. The shops occupy a level area extending back from a branch of the Black Warrior river, which supplies the water for all industrial purposes. The houses in the prevailing bungalow type of the South and set comfortably apart, were erected on the sides and summit of a ridge forming one side of the river valley. The attractive office of the foundry company is located on the main street not far from the general store and the post-office which is operated as a branch of the post-office in Tuscaloosa, a city about 6 miles to the south by either rail or highway.

The foundry group includes three main buildings. The first known as No. 3 and No. 4 foundry 146 x 840 feet is devoted to the production of soil pipe and fittings in diameters ranging from 2 to 15 inches. In the first section, or No. 3, the pipes on 16 floors are molded on machines made by the Beardsley & Piper Co., Chicago. On the remaining 10 floors, the molds are rammed by hand. Fittings are molded and cast in the second section of this building known as No. 4 foundry.

Pressure pipe in 6-foot lengths and in diameters from 4 to 16 inches is made on 32 floors in No. 1 foundry, a steel building in line with No. 3 and 4 and almost as long. No. 2 foundry, a separate unit, is equipped with a battery of molding machines and conveyors. Soil pipe fittings are molded on the machines, placed on the conveyor, poured while in transit near the cupola at one end of the foundry and shaken out at the other end. Considerable space in this building is devoted to the production of brakeshoes.

Extent to which standard and special fittings are employed in inside and outside pipe lines may be gained by noting Fig. 10. This steel and concrete building 60 x 100 feet is fitted on the inside with steel racks and shelves and is filled completely with patterns and pattern parts, approximately 4000 different items. In addition to the working patterns, aluminum or iron, the building also contains the original wood master patterns. Three transverse walls divide the building into four compartments and constitute an important factor in reducing the fire hazard. To all intents and purposes the building practically is fireproof.

Notices of various kinds, of which those appearing on the doors and end of the pattern storage building are typical, are on display everywhere throughout the plant and reflect the spirit of the management in promoting safety and cleanliness. Practical application of the same spirit is found in the modified mili-

Fig. 5—A Special Gang Shakes Out the Castings, Loads Them and Stacks the Flasks in Readiness for the Following Day

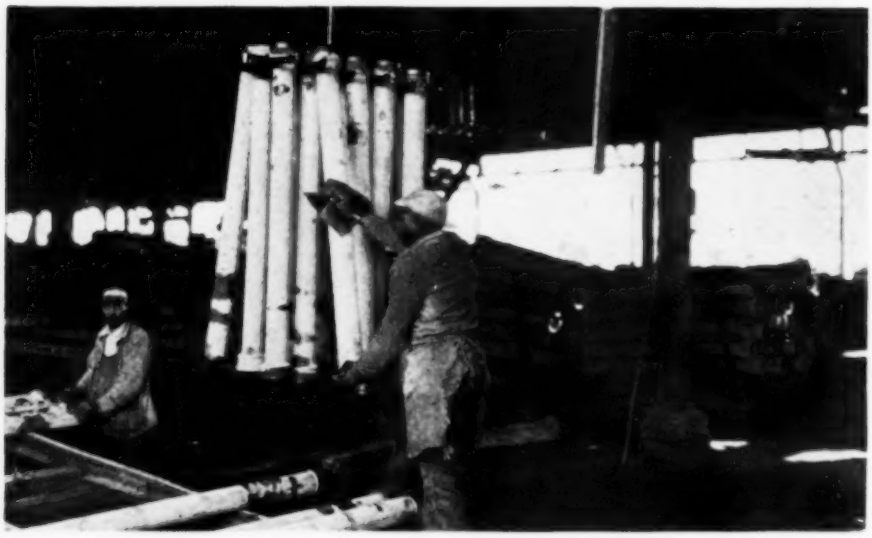


Fig. 4—Castings Are Picked up in Groups of 20 and Dipped in the Pitch Bath

tary form of organization under which the plant is operated. Gang bosses, key men, committee members and others responsible for the observance of rules and the maintenance of discipline, wear uniforms that proclaim their rank. Constant sight of these uniforms exerts a certain amount of influence on the rank and file of the workmen and through association of ideas promotes close observance of the various safety first rules.

Maximum production on the molding floors is obtained through a system which prevails in practically all southern pipe foundries. A certain number of molds, depending on the size, constitutes the day's work. Under normal conditions the task is completed approximately at the same time every day. Under the stress of extraordinary conditions and on special occasions the operating time has been materially reduced. Similarly on the blue days which, as in every other industry, occasionally manifest themselves in the foundry, the operating period has been prolonged beyond the normal quitting time.

Fig. 7—Small Fittings Are Packed in a Cage for Convenience in Dipping

Fig. 6—Green Sand Molds and Cores for Miscellaneous Fittings Are Made in Snap Flasks on the Molding Benches

Methods and equipment have changed to a considerable extent since this shop first was placed in operation in 1912. At that time the universal custom in the soil pipe casting industry was to ram the sand, lift the flasks, pour the iron and shake out the castings entirely by hand. The men worked in pairs and on the 4-inch diameter size they usually put up 38 molds, or a total of 76 pipe castings per day.

The width of the Central Foundry Co., shop in Holt, Ala., is based on this feature. The floor space between the gangways on either side is sufficient to accommodate 76 flasks, or in other words the output of two pairs of men working toward the center from opposite ends of the same sand heap.

Under this system the human element was an important and at times embarrassing factor. Important in the sense that a considerable degree of skill was required to ram the sand properly. Embarrassing when one half of any team failed to report for duty and an inexperienced man had to be pressed into service. Where the sand was rammed too soft the castings were over weight. Where it was rammed too hard the metal would not lie quietly against it. Under either condition the resulting casting had to go back to the cupola instead of the shipping room.

Installation of mechanical equipment a few years ago removed the human factor to a great extent from the equation. A great number of men still are employed, but the successful production of castings does not hinge on the particular skill of any member or of any group. The job has been broken down into a number of simplified parts within the capacity of the ordinary workman. Density to which the sand is rammed is under positive mechanical control. Places of absent members are filled readily without affecting the volume of output or the quality of the castings.

Soil pipe castings are made on 16 full length floors, each group of four floors served by a machine made by the Beardsley & Piper Co., Chicago. A crew of seven men operates eac.

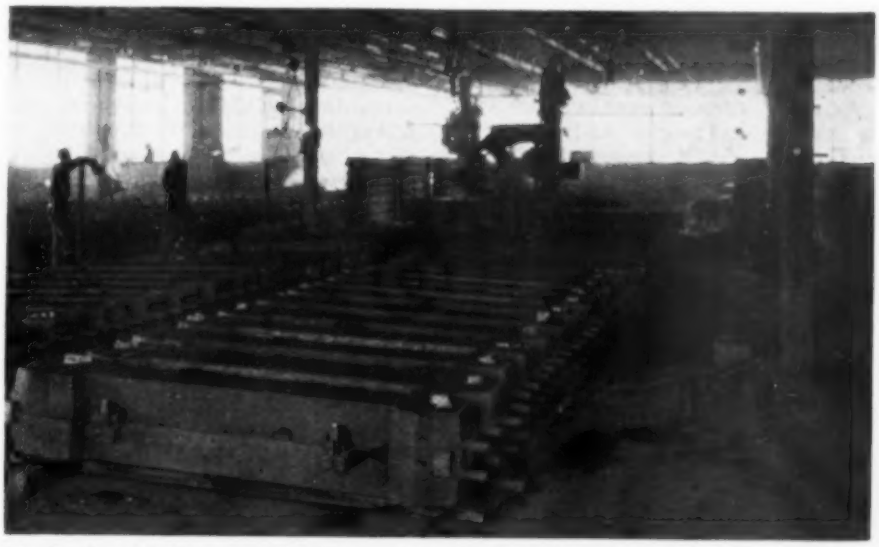


Fig. 8—Special Shape Flasks Reduce the Amount of Sand Required in the Molds

machine supplemented by a second crew of 3 men who make and set the green sand cores in 300 flasks, each containing the molds for two pipes, a total of 600 castings for the day's work of each unit.

The sand slinging machine travels backward into a long sand heap and tows the mounted patterns. The patterns are mounted in pairs on stripping machines, one machine for the copes and the other for the drags. The only difference between the two is that the pattern equipment for the cope machine includes the gates and runners. The empty flasks are stacked

Fig. 9—Each Section of Pressure Pipe Is Ground at Both Ends Simultaneously

in piles about 10 feet apart longitudinally on both sides of the floor. From 10 to 14 flask parts are stacked in each pile. Two 6-foot lengths of 5-inch steel pipe anchored in the floor and projecting upward through the stack, prevent the flasks from slipping ut of place until they are needed

In practice a cope is placed on one pattern plate and a drag is placed upon the other. The machine operator directs a stream of sand into the drag flask until it is filled. A man grasps the flask at each end by the handles, turns it over and places it upon two parallel concrete skidways 5 feet apart and extending flush with the floor from one side of the building to the other. This arrangement insures level molds and facilitates the work of the men pouring the iron later.

Drags and copes in succession are packed with sand, removed from the pattern plates and placed in proper position on the two floors flanking the molding apparatus on either side. The sand throwing machine travels under its own power, collects the sand from the heap, elevates it, riddles it and then throws it into each flask in turn with sufficient force to pack it to the required density on the patterns.

Aluminum flasks are used which it is claimed, present many advantages, including ease of manipulation. The principal features of these flasks may be noted in Figs. 1 and 3. Semicircular openings in the ends permit the core arbors to project about 6 inches. The projecting part of the arbor is not covered with sand. A short, blunt wood wedge is driven into the narrow opening between the upper side of the arbor and the end of the flask before the iron is poured into the mold. This is to counteract the lifting pressure of the iron under the core and insures a casting of uniform thickness.

Green sand cores are swept on cast iron arbors in a device located near one end of each floor. The clay-washed arbor is suspended horizontally between two centers and then caused to revolve rapidly while a narrow stream of sand falls from a hopper above. A permanent strike attached to the frame of the device removes the surplus sand and imparts a smooth finished surface to the revolving core. The small ridge which forms the lead groove in the bell end of the pipe is formed by the sweep on these cores which are remarkable examples of accuracy in dimension. Castings that vary more than 1/16-inch from the specified diameter, are rejected.

Two men carry the cores in pairs from the machine to the molds. They insert short sticks in the ends of the arbors and this amount of clearance enables them to straddle the row of molds. Their movement back and forth is marked by a gradually increasing tempo as the line of molds extends toward the back of the floor. The last cores are carried at a lively trot.

After the molding machine has consumed one pile of sand and two rows of molds have been laid down, one on each side, all the way across the floor, the machine is picked up by a hoist and set down at the beginning of a second sand heap. Procedure here is the same as in the first instance. Four machines are in operation and each of the four utilizes two sand heaps and fills the flasks for four rows of molds daily.

Cope and drag in each assembled mold are held together by four self tightening box clamps attached to four lugs at the flask joint. The clamp is tapered slightly on the inside to correspond with a taper on the lugs. With the clamp in place, a slight tap of a hammer will tighten it. Also, after the mold has been filled with iron, a second slight tap of a hammer will release the clamp.

Iron is melted in a battery of four cupolas, two 60-inch and two 72-inch diameter inside the lining. The smaller cupolas melt at the rate of 15 tons and the larger at the rate of 20 tons per hour. Air for one of the cupolas is supplied by a fan made by the B. F. Sturtevant Co., Boston. The others are serviced by blowers made by Willbraham-Green Co., Pottstown, Pa.

Conserves The Heat

The type of ladle and method employed in pouring these castings are shown in Fig. 1. The special ladle holds sufficient metal to pour from seven to nine molds, depending on the size of the castings. A flat plate over each end of the long ladle conserves the heat and with the deflectors on the bail, prevents the fierce heat from playing on the faces and hands of the men engaged in pouring the metal. These men receive the highest compensation in recognition of their skill, which enables them to pour the iron in a manner that will fill the molds without straining the walls, to distribute the iron in a minimum period of time and to check the streams in time to prevent overflows, formation of scrap metal and a wastage of iron.

The ladle is provided with four pouring lips daubed with clay made up as nearly level as possible. Minor inequality in the level line is adjusted by a turnbuckle in one arm of the bail by which the ladle is suspended from a monorail. This monorail system extends to all floors in the foundry and in front of the cupolas where the ladles are filled directly from a reservoir skimming spout.

Molten iron falls through the four upright sprue openings in each cope, into four gate units at the joint of the cope and drag and extending in the center between the two pipe molds almost from one end of the flask to the other end. Two thin gate openings 2 inches wide and 3 inches apart, conduct the metal from each runner directly into each mold cavity which is filled simultaneously at the center and ends and two intermediate points.

Thus iron enters each mold through 8 gates. In passing it is of interest to note that no risers are placed on the castings and no one troubles to light the vent as it escapes from the open ends of the arbors.

Molds are formed directly from the heap sand without any addition of coal dust and no facing is dusted on the faces of the molds. Castings cool so quickly that the sand is not burned to any extent and as a result only a small amount of new sand must be added to the heaps occasionally to maintain the bond. New sand exclusively is employed in making the cores. Excellent deposits of molding sand are available at several points in Alabama.

The shakeout gang follows closely after the men pouring the iron. A man armed with a wood mallet strikes the small end of each arbor and drives it into the casting. As a result the loosened arbor projects from the opposite end where it is grasped by another man, pulled out and carried to the vicinity of one of the coremaking machines and stacked in readiness for the following day's operation. In the comparatively short time elapsing between the pouring and the shakeout, the castings and arbors have cooled to such an extent they may be handled readily by men whose hands are gloved or protected by hand leathers.

Castings Are Loaded

Gates are knocked from the castings and allowed to lie in the sand until after the castings have been removed. Then they are collected and taken to the charging platform of the cupola. The castings are loaded on a double hook, somewhat resembling an inverted question mark, suspended from the monorail, and shown in the illustration Fig. 5. At the gangway the load is transferred to the type of truck shown in the background of Fig. 4 and taken to the cleaning room, where the castings are distributed among battery of 10 large and 8 smaller tumbling barrels.

Pressure pipe in 6-foot lengths are made in various sizes from 2 to 15 inches in diameter. The large sizes are made singly, but the smaller sizes are made two in a flask. The equipment and methods employed in this plant are practically similar to those in use at another of the Central Foundry Co., plants in Bessemer, Ala., described in the Nov. 15 issue of THE FOUNDRY.

After these castings are cleaned they are ground simultaneously at both ends and then passed on to a battery of special lathes where both ends are machined, one end male and one end female for a universal joint.

Soil pipe and pressure pipe fittings in almost endless variety are molded and cast in a department separated from the main foundry. A typical corner of this department where the molds are made on the bench in snap flasks, is shown in Fig. 6.

Special devices illustrated in Figs. 4 and 7 have been developed for dipping the castings in the pitch baths where they are coated inside and outside. After this treatment they are loaded directly into railroad cars, or, are placed in an extensive stock pile in the yard. An industrial track with the necessary switches and turntables facilitates the movement of castings at any time and to any point. Under normal conditions soil pipe and fittings are shipped at the rate of 15 to 16 car loads daily. The average shipment of pressure pipe is 50 cars per week.

Foundry Courses Offered

Extension division, University of Wisconsin, Madison, Wis., has prepared two courses in foundry practice that are available to foundrymen for study by the correspondence-study method. The two courses cover cupola practice and foundry metallurgy. These subjects are offered as a medium by which men employed in the foundry industry may secure advancement.

The course on cupola practice is elementary and practical and will appeal to foremen melters, and molders who are interested in improving their knowledge of foundry practice. Among the subjects covered in the course are the general construction and form of the cupola, tuyeres, bosh, lining, blower equipment, coke and iron ratios, coke, limestone, pig iron, etc.

Foundry metallurgy deals with cast iron and its uses, types of castings, characteristics of cast iron, effect of various elements, tests for physical properties, desired analysis, etc. Courses will be under the direction of Ben G. Elliot, professor of mechanical engineering at the institution. The instructor in foundry courses is Russel W. Fowler, assistant professor of mechanical engineering. The courses are available both to residents of the state of Wisconsin and also of other states.

Malleable Club Meets

The Malleable club, composed of malleable foundrymen in the Milwaukee district, met Jan. 6 at the Hotel Blatz, Milwaukee. The meeting was called to order by D. I. Dobson, Glancy Malleable Corp., Waukesha, Wis., president of the club. He then appointed a program committee consisting of C. M. Lewis, Badger Malleable & Mfg. Co., South Milwaukee, chairman; R. O. Flansberg, Belle City Malleable Iron Co., Racine; and H. F. Voelkel, Federal Malleable Co., Milwaukee.

Professors McCaffrey and MacKay, University of Wisconsin, Madison, spoke on the work the university is doing with groups in the metal trades and especially emphasized the work that is being done in relation to the foundry industry. J. A. Gitzen, Lindsay McMillan Co., Milwaukee, was the speaker of the evening.

Fig. 10—Patterns Are Stored in a Fire Proof Building Divided Into Four Compartments

The next regular meeting of the club will be held in Madison, Feb. 5, in connection with the fifth annual foundry conference at the University of Wisconsin.

Elected President

Clifford M. Messinger, formerly vice president and general manager, Chain Belt Co., Milwaukee, has been elected president of the company, succeeding C. R. Messinger, who resigned recently to become president of the Oliver Farm Equipment Co. C. F. Messinger has been with the Chain Belt since his graduation from Sheffield Scientific school, Yale university, in 1911. At that time he entered the organization as a student apprentice and served throughout the various departments of the company. He was appointed advertising manager in 1913, sales manager in 1916, general sales manager in 1920, vice president in 1922 and general manager in 1930 a position which he will continue to hold.

G. K. Viall, works manager since 1929 and connected with the Chain Belt Co. since 1921, was elected a vice president.

GERMAN FOUNDRYMEN

Work on Standardization

By John Mehrtens

UNDER the influence of scientific and practical researches a growing tendency for standardization may be observed. Foundrymen realize that the practical fitness of materials depends principally on the careful selection of raw materials and the selection of the operating practice.

In addition to these a close supervision of production and final testing is necessary to secure full value of the foundry product for its intended use. Accuracy in the analysis does not always guarantee uniformity of physical and chemical properties on the part of the castings. It is only in connection with a properly applied method of testing as the basis for acceptance that complete success can be secured and consumers be sure, as far as this is practically possible, of getting satisfactory castings.

Good Raw Materials Needed

Uniform specifications for various kinds of materials are also useful for securing economy in foundries. Pig iron, coke, refractories such as molding sand, clay and other materials should always possess the properties required for the purpose in view. Otherwise losses in the production of castings will be unavoidable.

In 1927, the author reported on standardization in the foundry at the convention of the German Foundrymen's association, and pointed out that in overseas countries the use of standard specifications received considerable attention. This is of great importance, because German industry is consuming large quantities of foreign raw materials, such as ores, fuel and metals.

Of late, the German Foundrymen's association has resumed activity with regard to the making of specifications for pig iron and foundry coke, but owing to difficulties that had arisen, nothing definite had been formulated. The committees for testing materials and standardization of quality requirements have finished the greatest portion of the preliminary work for standard specifications for refractory materials. A comprehensive exhibit of the respective tables and drafts for standards was shown at the Dusseldorf foundry exposition. The tables were prepared by Dr. E. H. Schulz, chairman of the committee on refractory materials. Moreover, the German Foundry Owner's association is endeavoring to conclude the tests with fireclay for cupolas, and these records, in addition to those on foundry sand, will form an appreciable supplement to the standard specifications.

Needs Are Outlined

WHILE considerable effort is being exerted in this country by various organizations to establish suitable standards for raw materials used in the foundry as well as for the products turned out by the casting shop, other countries also are endeavoring to provide uniform specifications. This article which is abstracted from a paper presented by the author at the Kiel meeting of the German Standards association, gives reasons for the need of standards in foundries and the work being done in Germany along those lines of endeavor.

It is to be regretted that consumers lack a full appreciation of the difficulties encountered in the production of castings. The German committee for the introduction of national standards will render a good service to foundries by propagating the utilization of standard specifications and the success will be increased by co-operation between foundryman and engineer, as producer and consumer of castings, a co-operation already practiced by the German Society of Engineers.

Necessity of co-operation between these essential men is evident from the statement that out of the 2,000,000 tons of castings produced by German gray iron foundries, about 60 per cent goes to the engine-building works, and to insure the production of the right kind of castings, fitted for the various requirements, the exchange of experience between foundryman and designing engineer is certainly indispensable. The later should not ask for a superior quality of metal in cases where ordinary quality will serve the purpose as well; and, on the other hand he should understand that a price, adequate to the method of production, must be paid in cases where high test cast iron is required.

The standard German specification for gray iron, DIN-1691 gives two main groups of machine castings, one without the other with quality requirements. Only a small percentage of machine castings, designated as Ge 26/91, with 37,000 pounds per square inch minimum tensile strength, enter into consideration. In none of all other classes of machine castings should any difficulties be encountered in machining.

Methods Are Improved

During recent years appreciable improvements have been made in molding, melting and pouring methods which make it easier to reach the high requirements cast iron has to meet. Foundrymen are of the opinion that the production of a high-test, standardized cast iron requires a foundry equipped on modern lines. However, this does not mean that a fairly well operated foundry might not be able to attain the standardized qualities of the ordinary grade of cast irons if proper attention is given to melting operations.

There is another point to be borne in mind by the users of high-test cast iron. As pointed out by Mr. Scharlibbe (Borsig Works), it is not a question of making test bars or show pieces, but rather of pouring faultless castings which correspond in every respect to the specifications laid down. Bearing in mind the rate of cooling and the thickness of the castings, especially at the changes of cross section, the proper molding and accurate dimensions are of utmost importance to obtain a successful casting. Therefore the designer should give careful attention to the question of interior shrinkage.

Standards for malleable iron, DIN-1692, have been completed. An essential feature of the standard is the division into four classes as follow: Commercial malleable iron; high-test, white-heart malleable iron; high-test, black-heart malleable iron, abbreviated *Schwarzguss* and black-

heart malleable iron with special magnetic properties. The standards for steel castings DIN-1681, have become known widely since their publication in 1925.

While standards for gray iron, malleable iron and steel castings have been mentioned specifically, considerable work has been done with nonferrous metals and alloys. The tendency for standardization with regard to fixing quality and testing methods and attaining economic work in foundries, becomes evident from the choice of appropriate raw materials (ingot metal and scrap) and their economic utilization. Details of standard trade customs in the nonferrous foundry industry have been described by Dr. Claus in *Die Giesserei*, vol. 21, 1929.

Close Supervision Necessary

Only by close supervision, and proved testing methods as well as by making the proper use of the results of research work, based on scientific and practical experiences, is it possible for the foundryman successfully to overcome difficulties and to insure economy in the plant under his direction. The foundryman has to meet increasing competition from the forged and stamped goods in the iron and nonferrous metal industries and he also has to defend himself against welded fabrication in the production of large engine frames etc., substituted for gray iron and cast steel. Increase of accuracy and quality on the part of the product and standardization of raw materials and uniformity in foundry operation can render valuable service in combating encroachment of the previously mentioned materials.

The collection of standard tables issued by the German committee on standardization, in 1929, is a proof that much has still to be achieved. Apart from the standards for materials, only standard table, DIN-1511, I and II on pattern and supplies has been published up to the present. In addition a uniform pattern and casting card is issued by the Association of German Foundry Owners in cooperation with the committee on plant economy. The card is intended to give a concise account at any time, of all details of patterns existing in the works and their use for the orders of castings. Particulars on such cards can be found in the *A.W.F. News* 1926, Vol. 27.

It is not intended to urge the standardization of foundry forms. Nevertheless it must be pointed out that these cards can give useful instructions with regard to keeping or improving the system necessary in the pattern shops as well as in other departments. These cards also are valuable in determining the costs and overhead charges. The basis for a uniform cost-account system in the foundry meanwhile has been issued by the association to supersede the so-called *Harzburger Druckschrift*. That also contains different kinds of tabulating forms, etc.

Just as for patterns, it is intended to standardize the more important lesser supplies in the foundry. The standards for nails, chaplets of various kinds have been completed, those for pattern accessories, frames, pattern and core plates, crucibles, ladles, riddles, etc. are in course of preparation. Apart from technical standards (screws, nuts, tubes, etc.), many standards for engines and apparatus have been adopted by foundries. Standardization of chains, wire ropes and gear parts for cranes and engine building also has been used to advantage by foundries.

If foundries, in co-operation with designing engineers and consumers, would take steps to convince wider circles of the utility of technical standards, success would come quicker, to the benefit of their establishments. It is difficult to state figures with regard to this benefit. However, mention may be made of a report presented at the Kiel meeting in 1929 where a statement was made to the effect that for a large shipbuilding yard the cost incurred for the standardization office amounts to less than 0.1 per cent of the sales and that the profit could be estimated as about twenty times the cost incurred. This means that standardization brings a profit to the shipbuilding yard of 2 per cent of the sales.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Temperature Is High

To the Editors:

On page 61 of the Nov. 15, 1930 issue under the heading "Castings Are Warped," mention is made of heat treating castings at 1200 to 1600 degrees Fahr. It appears to me that if the objective is to remove warping, a treatment at 900 degrees Fahr. is best. Such treatment was carried out on a number of glass machine plates which weighed 25,000 pounds each, and had to be non-warping. The same treatment has been employed for thin sleeve valve castings with resultant freedom from warping subsequent to machining. The treatment mentioned in the article will remove warping if cooling is slow enough, but the iron is softened and its wear resistance is lowered. Also there is a loss of from 10 to 20 per cent strength in heat treating at 1600 degrees Fahr.

Hamilton, O. James Ward

Advocates Green Sand

To the Editors:

Some time ago I saw an inquiry asking if annealing boxes could be made in green sand. I believe that the boxes can be made in green sand because, in 1920, annealing boxes were made with green sand cores at a foundry in which I worked. Although the mold was the usual dry sand type, it appears to me that it only would be a step to go to all green sand. Some patterns are paneled on the outside with ribs about 12 inches apart. The ribs have a tendency to promote cracking during cooling when cast in dry sand molds. If the core can be made of green sand, why not make the mold the same way?

My contention is that an annealing box is nothing more than four steel plates on edge to form the sides with another to form the top. Any steel foundryman would not hesitate to mold a flat plate in green sand and there is no difference in casting the same on edge. A thickness of metal, say 1½ inches, creates little heat as it rises in the mold, and will not scale or scab the wall. The gate should be broken or offset once or twice to break the long drop from the top to the bottom of the mold. The point opposite the opening into the mold should be such that the rush of metal will not cut the core. The production of good castings depends on a good facing, preparation of the mold, and the molder.

Euclid, O. Frank Didion

Alloy List Revised

In 1922 the American Society for Testing Materials published a list of nonferrous metals and alloys compiled by William Campbell which filled a long-felt need in industry where the names and compositions of those materials were referred to frequently. During the eight years since its first appearance, many new alloys have been developed, and to keep abreast of the times, a new edition of "A List of Alloys" has been published. The bulletin contains 64 pages with the materials grouped according to types of alloys. In addition to names and compositions, physical properties of typical alloys are included. Copies of the list may be obtained from the society, 1315 Spruce street, Philadelphia, for $1.50 in paper, and $2.00 in cloth.

The Merchandise Mart in Chicago, the World's Largest Building

A. F. A. Plans Chicago Meeting

PLANS for the annual meeting of the American Foundrymen's association in Chicago, May 4 to 8, provide for several new technical sessions, a broader program of papers and an interesting exhibition of equipment and supplies. In addition, many important plants in the Chicago district, which is the leading foundry center of the country, will be open for inspection throughout the four days of the convention.

As at the 1929 Chicago meeting, both the technical sessions and the exhibition will be held in one building. However, 50 per cent more exhibit space has been provided this year than was available at the previous meeting. Both the exhibition hall and the grand ball room of the Stevens hotel are to be used for exhibition purposes. Space applications have been mailed and space assignments will be made in the near future.

The program of the convention, which now is being arranged, will contain a variety of interesting papers and reports. Several new features have been added and papers are being arranged which will cover interesting new developments in foundry practice. One new feature of the Chicago meeting will be the session dealing with problems in patternmaking. The increasing attention which foundrymen are giving to pattern production led to the initiation of this session, and it is expected that the reception of this new feature will assure the holding of similar sessions at future conventions.

Another innovation of the 1931 program will be the shop-operation course on sand control. This phase will consist of a three-period instructional course for those who seek information on how to install a sand control department. A second new shop-operation course will be held dealing with malleable foundry practice.

Courses To Be Arranged

The five courses will all be arranged to give instruction in the fundamentals of gray iron, steel, nonferrous and malleable founding, and in sand control. Committees have been formed to arrange the schedule of each course, the personnel of the committees being as follows:

Steel Founding: Chairman, S. R. Robinson, chief metallurgist, Ohio Steel Foundry Co., Springfield, O., W. F. Wilson, assistant to works manager, American Steel Foundries, Indiana Harbor, Ind., D. Zuege, metallurgist, Sivyer Steel Casting Co., Milwaukee.

Malleable Founding: Chairman, J. B. Deisher, works manager, Columbia Malleable Castings Corp., Columbia, Pa., Walter L. Ranis, foundry superintendent, Union Malleable Iron Co., East Moline, Ill., A. M. Fulton, Northern Malleable Iron Co., St. Paul., A. Van Lantschoot, superintendent, Iowa Malleable Iron Co., Fairfield, Ia.

Nonferrous Founding: Chairman, E. R. Darby, Federal Mogul Corp., Detroit, D. E. Broggi, foundry superintendent, Neptune Meter Co., Long Island City, N. Y., William Marr, Ohio Brass Co., Mansfield, O.

Gray Iron Founding: Chairman, Max Kuniansky, works manager, Lynchburg Foundry Co., Radford, Va., C. J. Scullin, Mississippi Valley Research Laboratory, St. Louis.

Sand Control: Chairman, H. W. Dietert, research engineer, U. S. Radiator Corp., Detroit., L. B. Knight Jr., National Engineering Co., Chicago.

Round-table luncheon meetings also have been scheduled for the malleable, steel and nonferrous groups. The steel castings conference will be presided over by H. P. Evans, metallurgist, Hubbard Steel Foundry division of Continental Roll & Steel Foundry Co., East Chicago, Ind. Vice chairman of this meeting will be F. J. Stanley, general manager of Michigan Steel Castings Co., Detroit.

Chairman for the nonferrous group will be H. F. Seifert, superintendent of brass foundry, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Seifert will be assisted by F. L. Wolf, technical superintendent of the Ohio Brass Co., Mansfield, O.

These round-table meetings have assumed a most important place on the convention programs since inauguration of the first two at the 1926 Detroit meeting. Being practical and informal, their popularity has increased steadily, and it is expected that those of the 1931 annual meeting will bring out even more valuable discussion.

Sessions of general interest which have been tentatively scheduled include those on foundry costs, pattern production, sand research and apprentice training. Two cost sessions will be held, one on general foundry costs to discuss methods of figuring molding costs and data which the purchaser should furnish when requesting bids. The second cost session will be devoted entirely to nonferrous foundry costs.

The committees which now are organizing the sessions on metallurgical and production phases of the various branches of the foundry industry have secured a number of excellent papers. These papers will form the basis for three sessions on gray iron, two sessions on nonferrous castings, two on steel castings and one on malleable founding.

Book Review

Principles of Pattern and Foundry Practice, By William H. Richards, cloth, 6 x 9 inches, 121 pages, published by the McGraw-Hill Book Co., 370 Seventh avenue, New York, and supplied by THE FOUNDRY, Penton building, Cleveland, for $1.60 plus 15 cents postage and by the Penton Publishing Co. Ltd., 116-17 Caxton House, Westminster, for 5s 6d, postage extra.

This book is designed essentially as a text book for technical institutions and the course as outlined may be covered during a term of 72 hours including lectures. That is the equivalent of the amount of work required for either 2 or 3 hours credit in technical schools.

The course is divided into three parts covering exercises in bench and lathe work and a series of lecture problems. There are ten exercises in the first part, five in the second and the latter part covers material for 16 lectures. The instructions for making each pattern are minute in detail and the purpose of each exercise is explained at the beginning of the directions. Those exercises are simple as only the fundamentals of patternmaking may be taught in so short a time. The book contains 185 illustrations.

Problems discussed in the lecture course differ from those given in the exercises. A large amount of general information on pattern making and molding is contained in the first few lectures. Thereafter, methods employed in molding representative castings are discussed together with characteristics of various types of patterns for making typical castings.

Cleveland Foundrymen Hear Dr. Myers

More than 100 foundry managers, superintendents and foremen met at the Hotel Cleveland Saturday, January 17, at a meeting called by the committee on industrial education of the National Founders association. Ralph H. West, West Steel Castings Co., Cleveland, was chairman of the local committee fostering this meeting which considered problems relating to foundry management. Dr. Harry Myers, consulting industrial engineer, Dayton, O., spoke on the relationship of workmen and foremen and their joint responsibility in establishing order and cleanliness. Six principles which when properly observed were stated as laws of good work on the part of workmen and a corresponding series of six principles of foremanship tied in the co-operative precepts emphasized by Dr. Myers in his discussion.

Tentative Program

Monday, May 4

Registration.
Business meeting.
Opening of Exhibition.

Tuesday, May 5

Morning

Sand control shop-operation course, first session.
Gray iron founding.
Malleable founding.
Pattern production.
Nonferrous foundry costs.

Afternoon

Malleable founding round-table luncheon.
Foundry costs.
Shop-operation courses: Steel, Malleable, Gray Iron, Nonferrous, first session.

Wednesday, May 6

Morning

Sand control shop-operation course, second session.
Gray iron founding.
Nonferrous founding.
Steel founding.

Afternoon

Steel founding round-table luncheon.
Nonferrous founding round-table luncheon.
Sand research.
Apprentice training.
Shop-operation courses: Steel, Malleable, Gray Iron, Nonferrous, second session.

Thursday, May 7

Morning

Sand control shop-operation course, third session.
Gray iron founding.
Nonferrous founding.
Steel founding.

Afternoon

Annual business meeting and special lecture.
Shop-operation courses: Steel, Malleable, Gray Iron, Nonferrous.

At the afternoon session A. D. Lynch, personnel manager, Ohio Brass Co., Mansfield, O., emphasized the fact that foundry workmen do not ask any sort of welfare or paternalistic activity on the part of management, but they expect the management to provide six factors which follow: A proper place to work; proper equipment; proper wages; continuity of employment; opportunity to advance; and proper leadership.

In closing, L. W. Oslon, factory manager, Ohio Brass Co., Mansfield, O., spoke on management's opportunity and responsibility and emphasized that honesty and fair dealing are the fundamental concepts upon which management must build. Mr. Olson believes in establishing mutual confidence as the best means to obtaining better production and products.

This was the second of a series of meetings sponsored by the committee on industrial education of the National Founders association which is composed of the following: L. W. Olson, Ohio Brass Co., Mansfield, O.; E. H. Ballard, General Electric Co., West Lynn., Mass.; Clarence R. Falk, Falk Corp., Milwaukee; C. S. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa.; Dr. Harry Myers, Dayton, O.; G. K. Wilson, Deere & Co., Moline, Ill.

Executives Appointed

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently made the following appointments: Thomas S. Perkins, formerly manager of supply engineering and consulting engineer, now general manager of distribution engineering; R. W. Owens, formerly manager of industrial motor engineering, now general manager of industrial engineering; W. M. McConahey, formerly manager of the transformer engineering department, now consulting engineer, transformer engineering department with headquarters at Sharon works; H. V. Putman, appointed manager of transformer engineering department; M. S. Hancock, promoted to assistant manager, industrial motor engineering department; and R. E. Marbury, assistant manager, supply engineering department.

Papers Are Available

A 165-page bulletin containing papers and discussions presented at the Detroit regional meeting of the American Society for Testing Materials has been published by the Society. The bulletin is entitled "Symposium on Developments in Automotive Materials," and copies of the publication may be obtained from the society at 1315 Spruce street, Philadelphia, for $1.00.

Melts Semisteel

with Only Small Addition To Coke Charge

By Edward E. Marbaker

THE quantity of heat necessary to melt and superheat any material depends upon the number of heat units required to raise the temperature of a unit weight of the material one degree of temperature. This is called specific heat, and varies for different temperature ranges. Unfortunately few investigations have been carried on to determine the specific heat of cast iron and steel at high temperatures, and for that reason few data are available.

Few Figures Available

However, figures have been found which appear to be sufficiently accurate to be used in connection with the present problem. Oberhoffer in *Stahl und Eisen*, 47, 576-82 (1927) has reported that the average specific heat of pure iron from room temperature to the melting point (2760 degrees Fahr.) is 0.2071, that is $0.2071 \times (2760\text{-}60) = 559$ B.t.u., are required to bring one pound of iron to the melting point. To melt the iron at the same temperature, the latent heat of fusion must be added, and this Oberhoffer states to be 64.38 B.t.u. per pound. Here he is in fair agreement with other investigators. No figures for the specific heat of pure iron or steel above the melting temperature seem to be available. Therefore for the purposes of this discussion, the average specific heat of pure iron will be used although probably the actual specific heat at the higher temperatures is somewhat higher, as with cast iron.

The quantity of heat in one pound of steel at 2900 degrees Fahr., probably the highest temperature at which molten metal exists in the cupola, will be

$(2900 - 60) \times 0.2071 + 64$ or

$2840 \times 0.2071 + 64 = 652$ B.t.u.

In the *Transactions* of the American Foundrymen's association, vol. 36, 1929, pages 71-90, and in a Whiting Corp. publication, *The Operation of the Foundry Cupola*, which involve the use of the heat quantities of cast iron, the author has taken for the average specific heat of cast iron from room temperature 60 degrees Fahr. to the melting point 2260 degrees Fahr. the figure 0.19; for the latent heat of fusion 42 B.t.u. per pound, and for the specific heat of the molten metal 0.23. Thus the quantity of heat contained in one pound of cast iron at 2900 degrees Fahr. will be

$(2260 - 60) \times 0.19 + 42 + (2900 - 2260) \times 0.23$ or

$2200 \times 0.19 + 42 + 640 \times 0.23 = 607$ B.t.u.

Since the quantity of heat present in one pound of steel at 2900 degrees Fahr. is 652 B.t.u., and in a similar weight of cast iron at the same temperature is 607 B.t.u., it is evident that 7.4 per cent more heat is necessary to bring steel to 2900 degrees Fahr. than is the case with cast iron, and to produce this heat, more coke must be added to the intermediate charges, depending upon the percentage of steel in the mix.

Need More Coke

A good foundry coke containing 90 per cent carbon when burned completely to carbon dioxide, will evolve 13,100 B.t.u. per pound, and since to heat one ton of steel to 2900 degrees Fahr.

$2000 \times 652 = 1{,}304{,}000$ B.t.u.

are necessary, theoretically

$1{,}304{,}000 \div 13{,}100 = 99.6$

the pounds of coke that will be required. However, the cupola does not operate at 100 per cent efficiency, and hence more coke must be used depending upon the actual efficiency.

The same reasoning may be applied to cast iron. To heat to 2900 degrees Fahr. one ton of cast iron

$2000 \times 607 = 1{,}214{,}000$ B.t.u.

will be required, and the theoretical quantity of coke necessary will be

Presents Theory

MANY foundrymen believe that to melt mixtures containing even small quantities of steel scrap, in the cupola, it is necessary to use greatly increased quantities of coke. Consideration of the problem by the author Edward E. Marbaker, vice president, Industrial Research & Engineering Co., Pittsburgh, indicates that this is not true. He proceeds to figure theoretically the necessary additions of coke for a given percentage of steel in the charge. The result is presented graphically in the accompanying tables and illustrations. He admits that under ordinary working conditions the indicated high melting efficiency will not be attained, but that it is possible to approach it by carefully regulating the operation to obtain as complete combustion of the coke as possible. Also it must be borne in mind that the temperature of 2900 degrees Fahr., shown on the charts, is that of the melting zone and not that of the molten metal at the spout, which always is appreciably lower than the former.

Table I

Heat and Coke Required

Temp.	B.T.U. Required to Melt One Pound		Pounds Coke Required to Melt One Ton Charge at 100% Efficiency	
	Cast Iron	Steel	Cast Iron	Steel
2750	572.2	622.0	87.4	95.0
2800	583.7	632.0	89.1	96.5
2850	595.2	642.0	90.9	98.0
2900	606.7	652.0	92.6	99.5

Table II

Coke To Melt 1-Ton Charge

Temp.	Efficiency 25%		30%		40%		50%	
	Cast Iron	Steel	Cast Iron	Steel	Cast Iron	Steel	Cast Iron	Steel
2750.	340	380	291	317	219	238	175	190.0
2800	356	386	297	322	223	241	178	193.0
2850	364	392	303	327	227	245	182	196.0
2900	370	398	309	332	232	249	185	199.0

1,214,000 ÷ 13,100 = 92.7 pounds.

Assuming that the cupola is operating on all-steel charges with a melting rate of 10 to 1, that is, 200 pounds of coke to 2000 pounds of charge, the total heat available is

200 × 13,100 = 2,620,000 B.t.u.

and the heat required to melt and superheat the iron is

2000 × 652 = 1,304,000 B.t.u.

the thermal efficiency of the melting operation is

1,314,000 × 100 ÷ 2,620,000 = 49.8 per cent.

Under the same conditions, if a straight cast iron charge is involved, the heat required to melt and superheat it will be

2000 × 607 = 1,214,000 B.t.u.

and the thermal efficiency will be 1,214,000 × 100 ÷ 2,620,000 = 48.3 per cent.

The difference in melting efficiency in melting steel and cast iron charges is much less than would be assumed. It is unlikely that under ordinary conditions such a high melting efficiency will be attained in any case, although it is possible to approach it by carefully regulating the operation to obtain as complete combustion of the coke as possible. The temperature of 2900 degrees Fahr. shown is that of the melting zone and not that of the molten metal at the spout, which always is appreciably lower.

Efficiency Affects Requirements

In Table I and Fig. 1 are shown the B.t.u. required to melt and superheat one pound of iron or steel at temperatures from 2750 to 2900 degrees Fahr., and also the pounds of coke required to melt one ton of charge at 100 per cent efficiency.

From the figures shown in Table I, the weights of coke required to melt and superheat one ton of cast iron or steel at melting zone temperatures from 2750 to 2900 degrees Fahr. at various thermal efficiencies were calculated. These weights are set forth in Table II, and the variations shown graphically in Fig. 3.

It readily can be seen that for any given melting efficiency a definite weight of coke will be required to melt a ton of cast iron or steel charge,

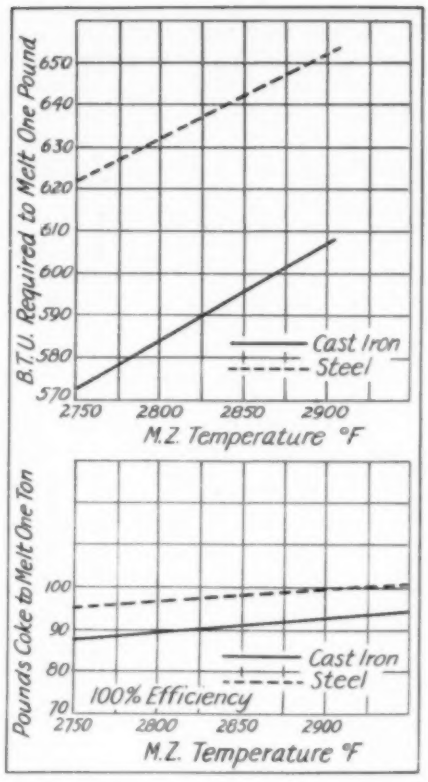


Fig. 1—B.t.u. Required To Melt and Superheat a Pound of Metal

and that this will vary both with the efficiency and with the percentage of steel in a mixed charge. From the figures already given, it is possible to construct a table which will show for each melting efficiency the weight of coke necessary to melt one ton of steel and one ton of cast iron at any temperature above the melting point. The total difference in the weight of coke required for an all steel and an all cast iron charge may be calculated, and this difference subdivided to indicate the difference for any given percentage of steel in a mixed charge. The results are shown numerically in Table III, and graphically in Fig. 2.

Fig. 2 shows the differences in weights of coke required in melting mixed charges containing various percentages of steel for the temperature 2900 degrees Fahr. only. Obviously similar charts can be prepared for each of the other temperatures from the figures set forth in Table III.

Table IV has been constructed to show that relatively little increase in the weight of coke to melt steel mixes is required. This shows the weights of coke required for melting all-cast iron and all-steel charges at 2900 degrees Fahr. and the differences involved. The total differences are further divided in Table IV to show the increase required for each 10 per cent steel in the charge.

The illustrations show that in melting a full charge of steel scrap in a cupola operating at 30 per cent efficiency, which is quite common, only 23 pounds more coke will be required than in melting a full charge of pig iron and scrap. With a 20 per cent steel charge, less than 5 pounds more coke will be necessary. The general idea that the melting of a semisteel charge requires much more coke, thus is shown to be erroneous.

The principal reason for melting steel scrap in a cupola charge is to reduce the carbon content of the resulting cast iron. It readily can be seen that the use of excess coke will have a tendency to defeat this purpose because there will be a greater opportunity for the molten metal to absorb carbon.

Charts Show Value

The charts show excellently the economic value of melting the charges at the highest efficiency possible. This works out in at least two ways—less coke is required at the higher efficiencies and smaller increases are necessary to take care of the steel in the charge. Figs. 2 and 3 show that the differences decrease as the efficiency of melting increases.

Due consideration must be given to the volume of air supplied. Since the weight of coke must be increased in melting mixed charges it is evident that the volume of air also must be increased. To make the problem more concrete an example may be taken to show how the weight of coke and volume air should be taken into account in melting mixed charges.

According to Table III, 264 pounds of coke is required to melt one ton of

Table III

Efficiency Varies Coke

Temperature Efficiency	2750°F. Cast Iron	2750°F. Steel	2800°F. Cast Iron	2800°F. Steel	2850°F. Cast Iron	2850°F. Steel	2900°F. Cast Iron	2900°F. Steel
20%	437	475	446	483	455	490	463	498
25	340	380	356	386	364	392	370	398
30	291	317	297	322	303	327	309	332
35	249	272	254	276	260	280	264	284
40	219	238	223	241	227	245	232	249
45	194	211	198	214	202	218	206	221
50	175	190	178	193	182	196	185	199

Table IV

Steel Causes Coke Difference

Efficiency of melting %	Lbs. Coke necessary to melt 2000 lbs. Steel at 2900°	Lbs. Coke necessary to melt 2000 lbs. Iron at 2900°	Difference lbs.	Difference per 10% Steel lbs.
20	498	403	35	3.5
25	398	370	28	2.8
30	332	309	23	2.3
35	284	264	20	2.0
40	249	232	17	1.7
45	221	206	15	1.5
50	199	185	14	1.4

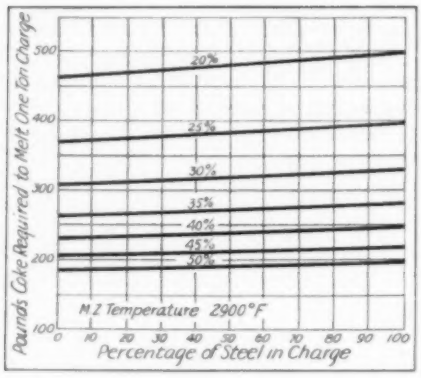


Fig. 2—Percentage of Additional Coke Required for Steel Additions

iron at 35 per cent efficiency with a temperature in the melting zone of 2900 degrees Fahr. This is a coke ratio of 7.58 to 1. Approximately 135 cubic feet of air is necessary to burn one pound of coke (90 per cent carbon) completely to carbon dioxide; that is, to produce the greatest possible quantity of heat. To burn 264 pounds of coke the air requirements will be 264 × 135 = 35,600 cubic feet.

In a 54-inch cupola, for instance, with a melting rate of 10 tons per hour or 1 ton in 6 minutes, the air supply will be 35,300 ÷ 6 = 5940 cubic feet per minute.

According to Table III, 284 pounds of coke will be required if a charge containing 100 per cent steel is to be melted. The total difference in coke is 20 pounds and for a 20 per cent steel charge, it will be only 4 pounds. The coke required will be 268 pounds and the air supplied should be 268 × 135 = 36,200 cubic feet.

Assuming that the melting rate does not change, the air supply will be

36,200 ÷ 6 = 6030 cubic feet per minute, an increase of 90 cubic feet per minute.

In changing to a charge containing 20 per cent steel, the coke must be increased 4 pounds and the air supply 90 cubic feet per minute for each ton. The same method of calculation can be used for any set of conditions. The necessary figures are presented in the various tables. The lower the efficiency at which the cupola operates, the greater will be the increase in weight of coke necessary and therefore the increase in the air volume also will be greater.

Foundrymen in too many instances allow the air supply of the cupola to take care of itself. Actual demonstration has shown that when the necessary air-meausring devices are used, and nearly complete combustion of the coke attained, the melting rate increases, the iron is hot at the spout, and a considerable amount of coke is saved. Usually too much coke and an improperly regulated quantity of air are used. For this reason, in this and other articles, the author has emphasized the use of the fundamental thermochemical data. No cupola can be operated regularly to the best advantage when air-measuring equipment and a pyrometer are not available.

Institute Conferences To Be Held in South

Gray Iron institute, Terminal Tower building, Cleveland, has scheduled a series of conferences in important industrial centers throughout the South. The meetings are held to inform gray iron foundry executives of the activities under way in the various departments of the institute. The following meetings are scheduled at which gray iron foundry executives are welcome: Feb. 6, Statler hotel, St. Louis; Feb. 10, Muehlebach hotel, Kansas City, Mo.; Feb. 13, Huckins hotel, Oklahoma City, Okla.; Feb. 16, Adolphus hotel, Dallas, Tex.; Feb. 18, Rice hotel, Houston, Tex.; Feb. 20, St. Charles hotel, New Orleans; Feb. 27, Tutwiler hotel, Birmingham, Ala.; March 2, Ansley hotel, Atlanta, Ga.; March 4, Read house, Chattanooga, Tenn.; and March 6, Brown hotel, Louisville, Ky.

Book Review

A.S.T.M. Tentative Standards 1930, paper or cloth, 864 pages, 6 x 9 inches, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $7.15 in paper and $8.15 in cloth, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 14s and 16s respectively, postage extra.

Each year the American Society for Testing Materials publishes a volume containing all the tentative standards in effect during the year. The term tentative standard as distinguished from standard applies to a proposed standard which is printed for one or more years for the purpose of eliciting criticisms before final adoption. The present volume contains 155 tentative standards which relate to ferrous and nonferrous materials; cement, lime, gypsum and clay products; preservative coatings; road and paving materials; rubber products; coal and coke, etc. The tentative standards of interest to foundrymen include: electric cast-steel stud-link anchor chain; austenitic manganese-steel castings chilled-tread cast-iron wheels; aluminum-base casting alloys in ingot form; aluminum-base alloy castings; magnesium-base alloy castings; sand castings of the alloy 80-10-10; copper-base alloys in ingot form for sand castings, and chemical analysis of aluminum and light aluminum alloys. Tentative revisions of standards include those on high-test gray-iron castings; chilled cast-iron wheels; bronze bearing metal in ingot form, and chemical analysis of manganese bronze.

Equipment Orders Rise

Index of gross orders for foundry equipment increased from 45.3 in November to 59.8 in December, according to a recent report of the Foundry Equipment Manufacturers' association. Index of shipments rose from 76.5 in November to 102.6 in December. Unfilled orders were off from 124.9 in November to 82.3 in December. The base is the average monthly shipments for the years 1922-23-24. Comparison of monthly orders as presented by the association follow:

Month	1927	1928	1929	1930
Jan.	180.4	132.7	180.5	160.1
Feb.	198.0	123.6	197.0	196.4
March	131.1	138.6	209.4	164.1
April	130.0	107.7	172.6	122.8
May	134.8	335.6	177.7	92.7
June	138.4	149.1	177.3	102.1
July	89.9	94.8	219.3	90.6
Aug.	106.4	278.0	229.5	85.2
Sept.	80.4	170.0	216.3	91.0
Oct.	98.0	185.0	245.3	50.0
Nov.	95.8	197.8	178.6	45.3
Dec.	106.8	166.5	208.0	59.8

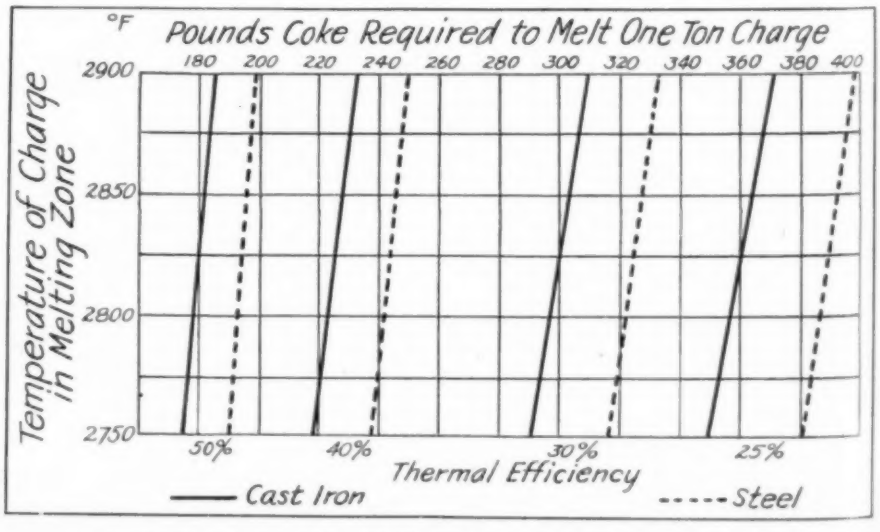


Fig. 3—Coke Required To Melt and Superheat One Ton of Metal

The FOUNDRY Family Photograph Album

Upper Left

H. A. SCHWARTZ

National Malleable & Steel Castings Co., Cleveland

Upper Right

W. P. BRADLEY

National Steel Foundries, Milwaukee

Lower Left

H. C. DEWS

Dewrance & Co., London, England

Lower Right

W. H. FITCH

Richards-Wilcox Mfg. Co., Aurora, Ill.

REGULATIONS FOR THE INSTALLATION OF

PULVERIZED FUEL SYSTEMS

(Continued from Data Sheet No. 846)

coal or by a suitable alarm system which will notify the operator that the separator is not functioning.

(b) The magnetic separator shall be of such size as to expose and insure the removal of tramp iron or other magnetic substances.

(c) One separator if of sufficient size and strength may serve a group of mills.

ELECTRICITY FOR LIGHT AND POWER

17. (a) All electrical equipment for light and power in pulverizer house shall conform with the *National Electrical Code*. Provision shall be made for remote control in order that current for light and power may be cut off in an emergency without entering pulverizer house.

(b) In no plant shall coal storage bins, conveying machinery or fuel pipe lines be used as supports for electric lighting or power lines other than those installed in conduit.

GROUNDING OF MACHINERY

18. Static electricity shall be removed from such machines or equipment as accumulate a charge by permanent ground wires and from belts by grounded metal combs or other equally effective methods. Grounds shall be attached to equipment and to the earth in accordance with the *National Electrical Code*, Article 9.

DUST COLLECTORS

19. (a) All dust collectors (except those of cloth type) shall be constructed throughout of non-combustible materials; cloth type collectors should be provided with dust tight enclosures or their equivalent. The fabric of cloth type collectors shall be electrically grounded as required by paragraph 18. All dust collectors used in connection with the pulverizing systems, unless located in the department devoted to the pulverizing, drying or storing of coal, or in connection with transport systems on *Class A* bins, shall be located in a separate room unless the proportion of oxygen within the separator is maintained at less than 13 per cent. Dust collectors, and rooms in which they are located shall be properly vented to a safe point outside of the building.

(b) Cyclone separators shall meet the following minimum requirements:

1. The shell and thimble shall be made of 3/16-inch steel plate.
2. All seams shall be welded or riveted and welded.
3. All flanges shall conform to the flanges used on connecting piping.

VENTS

20. (a) Safety relief vents shall be liberally provided on all pulverizing equipments, particularly in the discharge of the mill in *Class A* and *B* systems, or in the case of air separating systems, at the top of the return duct to the mill; ta elevator heads, at every storage bin for pulverizing fuel and at dust collectors. Storage bin vents shall have a cross-sectional area suffciently large to permit the separation of air from fuel without building up an abnormal pressure within the bin. Safety relief vents taken off pipes and flues shall be of at least the same area as the pipes and flues vented; they shall lead by the most direct practicable route to the outside air in as nearly a vertical direction as practicable; and shall not deviate more than $22\frac{1}{2}$ degrees from the direction of the pipe or

(Continued on Data Sheet No. 848)

REGULATIONS FOR THE INSTALLATION OF

PULVERIZED FUEL SYSTEMS

(Continued from Data Sheet No. 847)

flue from which they lead. Horizontal runs shall be avoided. Suggested forms of relief vents are shown in Fig. 7.

Note. This rule does not apply to operating vents, meaning thereby such vents as may be required for efficient means of operation. Such vents may be connected into natural draft boiler stacks or breechings into same, or into an induced draft suction near the fan, or into the furnace, provided they are equipped with automatic balanced, non-corrodible dampers opening in the direction of the normal draft.

In no case shall operating vents be permitted to deliver into the open room.

(b) Where operating bin and mill vents are discharged into the furnace, each pipe to the surface shall be provided with a fan; fan and discharge pipe shall be so proportioned that the velocity in the discharge pipe from the fan is not less than 70 feet per second. Each fan shall be provided with tight inlet and outlet dampers, arranged to open only when the flow is toward the furnace, to close automatically on interruption of flow and be positively held closed when the fan is not in operation. The pipe from the fan to furnace shall be laid out at such an angle as to provide no place for dust to accumulate and from the outlet damper to the furnace shall be at least equal to the requirements of Section 26, Specification No. 2.

BLOWERS HANDLING FUEL IN SUSPENSION

21. (a) Blowers shall be installed on proper foundations and secured in a substantial manner. They shall not be used for any other purpose, but this shall not be construed as prohibiting the use of a blower as a means of supplying secondary air also.

(b) Bearings of blowers handling fuel in suspension shall not extend inside of blower casings or ducts.

(c) All connections between discharge end of blower and main duct shall be made so as to prevent leakage of fine dust. (See Regulations for Blower and Exhaust Systems.)

Note. Nonferrous metals need not be used in the construction of fan blades or lining of fan castings.

DRIERS

22. Fuel may be dried either in the raw state or during the process of pulverizing, in the mill and separating system.

(a) Raw fuel driers may consist of three types, the direct and semi-indirect types which are fired by special furnaces, and the indirect type in which coal is dried by means of inert gas from boiler breechings or by means of steam or hot air before entering the mill.

(b) Driers of the direct and semi-indirect types shall be so designed and constructed that the products of combustion of the heating unit shall not come in contact with the fuel being dried, except at a distance of at least one-half of the length of the drier, and in no case within 12 feet of the fuel bed.

Such driers shall be designed to prevent gases of combustion from entering its shell when not in operation.

On account of the danger of spontaneous ignition due to overheating coal, the use of this type of drier should be confined to fuels having a high ignition temperature.

(c) Driers may be installed in boiler rooms of fire-resistive construction, cut-off in a standard manner from the rest of the plant. When drier is located in a boiler house, construction of latter shall be of non-combustible material.

(Continued on Data Sheet No. 849)

THE FOUNDRY DATA SHEET, FEB. 1, 1931
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Questions & Answers on FOUNDRY PRACTICE

GRAY IRON

Gray Iron Is Tinned

QUESTION

What is the proper method of tinning gray iron castings?

ANSWER

Tinning of gray iron castings must be done carefully if a continuous coat free from pinholes is desired. The first essential is that the castings must be perfectly clean. Sand may be removed by sandblasting, tumbling, or pickling in hydrofluoric acid. The acid solution contains about 1 part of hydrofluoric acid to 20 parts of water. If the molds have been face with graphite coatings or rosin core binders have been used, the castings must be treated with a hot, strong caustic solution. After the castings are cleaned, they are dipped in a weak solution of hydrochloric (muriatic) acid containing about 1 part acid to 40 water for a few seconds. The castings next are dipped into a solution of zinc chloride containing 5 pounds of granulated salammoniac per gallon of solution. The zinc chloride is formed by adding zinc to hydrochloric acid until no more dissolves.

The castings now are ready for immersion in the first tinning kettle in which the metal is kept at a temperature of 500 degrees Fahr. To prevent spattering and oxidation of the tin, a flux composed of zinc chloride and salammoniac is used on the latter. The flux must be kept free from lumps by adding more chlorides and skimming with a perforated ladle. The castings must be immersed below the surface as carefully and rapidly as possible, and held in the molten tin until both are at the same temperature.

When that condition is fulfilled, the castings are ready for the second or finishing kettle. The molten metal in the second kettle is maintained at about 400 degrees Fahr., and is covered with a layer of tallow containing 10 per cent palm oil. The castings are immersed in the kettle for a few seconds and then removed with a swinging motion to shake off the excess tin. The tinned castings are plunged into a bath of kerosene to cool. When cooled the castings are placed in a vat of boiling water to remove the oil, and then dried in soft wood sawdust.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as foliows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions should be addressed to the Editor, The Foundry, Penton Building, Cleveland.

Q & A

Chill-casts Gray Iron

QUESTION

Have you any information on the chill-casting of gray iron? I am especially interested in mold construction, materials used for both the casting and the chill, and in the estimation of the shrinkage. Are there any text books on the subject?

ANSWER

It is difficult to determine from your inquiry whether you are referring to what usually are called chilled castings; that is possessing a white exterior of varying depth backed by a gray interior, or to completely gray iron castings produced in metal molds. In the production of the first variety which is exemplified by chilled car wheels, rolls, crusher jaws, etc., it is necessary to employ heavy chills against which the iron is cast. If they are not heavy enough, the heat is not extracted from the molten metal rapidly enough to give the desired depth of white fracture iron. The chills must be made of a high quality gray iron which is fine-grained and dense. The silicon content will depend on the section of the chill and should be such to give the characteristics mentioned.

Iron for the castings should have the phosphorus below 0.30 per cent, and manganese from 0.50 to 0.75 per cent. The depth of chill is controlled by the silicon content. Beginning at 0.90 per cent silicon, the chill depth will be around ½-inch; at 0.80 per cent—⅝-inch; 0.70 per cent ¾-inch; 0.60 per cent—1 inch; 0.55 per cent—1¼-inch, and 050 per cent—1⅜-inch. These data are for iron that is melted hot and poured quickly. If the iron is cold, the chill depth will be less than that given for the silicon ranges.

In permanent mold castings, a different view is presented. The castings are desired gray throughout so that they may be machined like those cast in sand. Consequently, the silicon content is considerably higher than that used for chilled work. The proper amount will depend upon the section of the casting and may range from 1.50 to 3 per cent; the higher range being used for the thinner castings. The permanent mold as in the case of the chill will have to be made from a fine-grained, dense iron, and heavy enough to absorb considerable heat without exceeding a temperature of around 800 degrees Fahr. Faces of the mold are coated with various ingredients to protect them from the action of the iron, and to form a

thin insulating medium between the molten metal and the mold. That also counteracts the tendency of molten iron to chill when cast against a relatively colder surface. Lime wash and a thin coating of clay have been employed.

Considerable experimenting will be necessary on your part to determine the proper thickness of the mold, and the design so that good castings will result. Investigation also will have to be made on metal compositions to ascertain the best composition for a given casting so that the casting will not have to be annealed when removed from the mold.

As far as we know there are only two books that deal with the subject of chill cast iron and permanent molds. The first deals wholly with chill-cast rolls and is entitled "Manufacture of Chilled Rolls," by A. Allison. The other is in German and is entitled "Eisenguss in Dauerform," by Janssen. If you are interested in permanent mold castings, we suggest that you get in touch with firms making a specialty of that type of design.

GENERAL

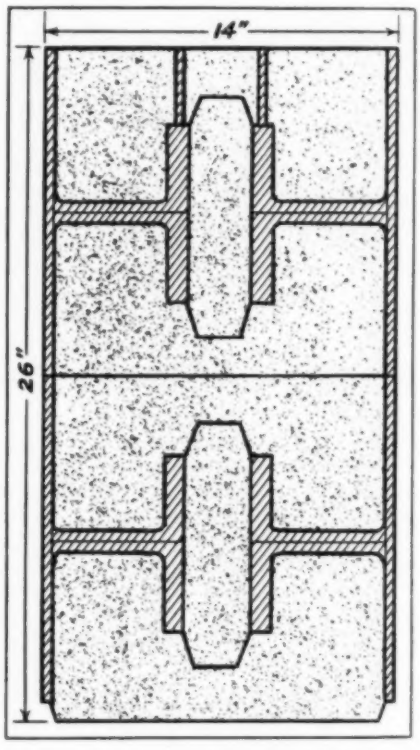
Pulley Hubs Shrink

QUESTION

We shall appreciate your opinion on the best way to make a pulley 14 inches diameter, 26-inch face, with two hubs and two sets of arms. The hubs are four inches diameter, 7 inches in length and are bored out to 2 7/16 inches. These castings are poured through two ½-inch diameter sprues on the top hub. We find shrinkage spots on the inside of the upper hub on some of these castings. The shrunken area appears at a point an inch or two below the top of the hub. We have a good head of metal in the runner and take a small riser off the rim. Would you favor pouring this casting between the arms, or, the present method with a feed riser on the hub in addition to the sprues.

ANSWER

From your letter head we note that you make both iron and steel castings, but from the gating system outlined, we infer that you are referring to a cast iron pulley. The usual method in gray iron foundries is to mold a casting of the dimensions outlined in green sand with a dry sand interior. In this particular instance the inside dry sand core would be made up of four sections, two for each set of arms. A solid cylindrical pattern with a disk core print on the bottom serves as a pattern. After it is drawn out of the sand the four core sections are lowered into place, either separately or fastened together. Owing to the fact that the face of the pulley consequently, is machined, it is not customary to apply any blacking to the face of the mold. Your method of pouring the metal into a casting of this kind, is the one usually employed. The statement that a good head of metal is used, indicates that you are familiar with the necessity of this feature. From the evidence submitted we are inclined to the opinion that your trouble is due to a soft mold, or a flask which yields to pressure when the mold is filled with molten metal. Check the diameter top and bottom with a pair of calipers. The yielding mold draws metal through the upper arms from the hub after the small gates have frozen. The



Dry Sand Cores Form Inside Section of Casting

obvious remedy is to ram the sand harder around the pattern, particularly near the bottom. Probably you may have to use a coarser or more open grade of sand than that in use at present. Another method is to gate the casting on the outside of the rim at the top, with a few branches, or, preferably a complete ring with branches about 2 inches apart. This will equalize the cooling speed of the rim and hubs.

Q & A

Slag Forms in Cupola

QUESTION

For the second time in a month the slag in the cupola has been blown into froth. We are melting 30 tons of wheel iron daily in a cupola lined to 48 inches and twice during the past month we have had to drop the bottom in the middle of the heat on account of cold, hard iron and a cupola filled with a frothy slag. We use a blended coke, large and dark, similar to that used in other wheel shops. Analysis and other features indicate that it is quite suitable for our class of work. A uniform blast pressure is assured by a recording pressure gage. We shall greatly appreciate an explanation of the phenomenon and how to prevent it.

ANSWER

Since you probably are more interested in preventative measures than you are in theories on the probable cause of the trouble, we think if the coke and iron are charged in proper proportion you will have no further trouble. The fact that the heats went wrong only twice during the month seems to indicate that your materials are not at fault. Therefore, the logical conclusion is that the trouble is due to manipulation of these materials.

Cold and hard iron may be due to a variety of causes, but in the present instance we are inclined to the opinion that it is caused by a lack of sufficient coke either in the bed or between the charges. In fact it is not improbable that a charge of coke was omitted altogether. Theoretically, this cannot happen, but in actual practice it has happened many times. Occasionally the same effect is achieved by the method of charging. The coke is forked to one side of the cupola instead of being spread uniformly. As a result the iron in one charge actually touches the iron in the preceding charge. The charges in your cupola are made up of broken wheels and pig iron, heavy, chunky stuff and the temptation is present to dump it in through the charging door in the easiest possible manner. The remedy is to visit the charging floor personally and establish a rigid charging schedule. Then place a responsible man in charge who will see that proper conditions are observed. After the coke bed has *burned through and settled* it should extend approximately 2 feet above the tuyeres. Then a thickness of 6 to 12 inches of coke is added, followed by the first charge of iron. Subsequent charges of iron and coke will be approximately 2000 pounds of iron and 200 pounds of coke. These weights may be varied to a considerable extent since the cupola is only scheduled to remain in blast about 3 hours, but the majority of foundrymen have found that a 48-inch cupola works best on the foregoing charge. With a good grade of limestone, 30 to 35 pounds is sufficient to add to each 100 pounds of coke. By watching the color and fluidity of the resulting slag, the correct amount of limestone may be adjusted if necessary. Limestone is added to every charge. The slag hole is opened about half an hour after the

blast goes on and thereafter the slag should flow freely. Slag wool floating in the air is evidence of proper slagging conditions. However, as stated previously, this is an instance in which the human factor is the one that needs attention. Sharp supervision on the charging floor will prevent recurrence of trouble.

Q & A

Bentonite Is Clay

QUESTION

What is bentonite? In a recent paper presented before the American Foundrymen's association it is referred to as a binder to be used with or without cereal binder in the preparation of green sand facing for steel. The author states that it is used to replace the clay bond.

ANSWER

In his book on *Clays*, Heinrich Ries, professor of geology, Cornell university, Ithaca, N. Y., describes bentonite as: "A widely distributed and peculiar type of clay, considered to be the result of devitrification and chemical alteration of the glassy particles of volcanic ash or tuff. The material originally was called *taylorite*, after William Taylor of Rock Creek, Wyo., who first called attention to it, but as this name already had been allotted to another mineral, the name of *bentonite* was used, because of its occurrence in the Fort Benton series of rocks. The material is widely distributed and has been reported from every state west of the Missouri river, also from Kansas, Oklahoma, Texas, Louisiana, Arkansas, Tennessee, Alabama, Virginia, Kentucky, Pennsylvania, Minnesota, Wisconsin, etc. In Canada, bentonite deposits have been noted in Manitoba, Saskatchewan, Alberta and British Columbia. It also has been found in Alaska and foreign countries." Among its uses may be listed: A bond for foundry sand; an adsorbent; a retarding agent in gypsum plasters; a suspending agent in pottery glazes; for dewatering petroleum, gasoline and different oils.

Q & A

Borings May Be Melted

QUESTION

We are interested to know whether cast iron borings and chips are being melted succesfully in the cupola for light, thin household hardware castings. In the past we have sold all this scrap, because we have been advised that it increases oxidation and in all probability would increase our scrap loss. Any information you can give us on this subject will be appreciated.

ANSWER

Any attempt to charge borings in a loose state will result in oxidation, but where they are charged in compact form, either as briquets or in suitable containers, the resulting metal is satisfactory. The amount of borings you have on hand from day to day, will determine the best method in preparing the borings for the cupola. Several automobile foundries have installed powerful hydraulic machines which compress the borings into briquets approximately 4 inches in diameter and 3½ inches thick and weighing about 7 pounds. In one large installation the output is 40 tons per day and the briquets form a part of the regular cupola charge for a class of castings that must pass rigorous physical and chemical tests. It is stated that the saving effected will pay for the machine in a short time.

For many years foundries in various parts of the country have charged borings loaded in lengths of stovepipe, etc. The borings are packed by hand or on a jolt machine and the ends of the containers are hammered over to seal them. In "Melting Iron in the Cupola" J. E. Hurst, devotes a chapter to the subject of briquets, their preparation in various ways and their effect in various mixtures.

Q & A

Iron Has Close Grain

QUESTION

Can you give us any information on a suitable anlysis for making engine blocks that will have a close grain and machine well?

ANSWER

One of the large automobile producers adjusts its mixture for cylinder blocks to produce iron of the following analysis: Silicon, 2.30 per cent; sulphur not over 0.10 per cent; phosphorus, 0.20 per cent, and manganese, 0.70 per cent.

Q & A

Pattern Storage Methods

QUESTION

Have you any data available on pattern storage, particularly on temperature, humidity control and methods of storing patterns?

ANSWER

Patterns should be kept in a well-ventilated, fireproof room separated from the foundry proper by a heavy wall, or in a building built for this purpose. The temperature and humidity should be as near to that in the foundry as possible. If the patterns become too dry they may warp. Also if they become dry in storage and are taken into the foundry, the patterns may absorb water rapidly and warp. In the summertime the foundry and the pattern storage will be subjected to approximately the same conditions of temperature and humidity so no special precautions need be taken. In the winter the pattern vault should be kept at a uniform temperature and as near that of the foundry as possible. Ordinarily this will be about 60 degrees. One firm making hot air furnaces uses one of its furnaces to heat the pattern vault.

Another large manufacturer of electrical machinery employs steam heat to maintain the proper temperature. With steam heat we suggest that the venting of the radiators be carried outside the room to prevent the condensed moisture being driven into the room when the radiators are alternately cooled and heated. This has a tendency to raise the humidity. Probably the best method of storing patterns is to use sectioned shelves. Supports for these shelves may be constructed of pipe or angle irons, and the shelves may be steel plates or wood. The sections of shelving are numbered or lettered as are the shelves. The patterns are classified and numbered, and a record kept of each on a card index system. When the pattern is stored, a notation is placed on the pattern card as to its location by section and shelf. A glance at the card will enable anyone to find it easily. When the pattern is sent to the foundry, the card is removed to another file known as the active file. Notations on the card give number of castings desired, molder, etc.

STEEL

Old Sand Thrown Away

QUESTION

Is there any way of utilizing sand discarded from the steel foundry? Our facing is made up of new silica sand, some old sand and binder. We use such a large quantity of this facing that the heaps become large and unwieldy. Up to the present we have to haul approximately 100 tons away to the dump every month.

ANSWER

So long as you continue adding a great quantity of new sand to your heaps, so long will you be obliged to discard a considerable quantity every day to maintain a constant volume on the floor. However, it is just possible that you are using more new sand than necesary in the facing. For dry sand molds and for heavy castings new sand, pure or nearly pure is required, but for light green sand molds the amount of new sand may be reduced in some instances to the vanishing point. Where old sand is used continuously some method must be adopted to remove the dust and silt either by washing or by some form of exhaust system. One such system in use in a prominent Mid-West foundry is described in the Aug. 1, 1930, issue of THE FOUNDRY. The subject of sand conservation and reclamation was treated extensively in a series of articles that appeared in THE FOUNDRY consecutively from March 1 to May 15, 1926.

Problems in Nonferrous Founding

By Charles Vickers

Aluminum Overheated

We are casting aluminum automobile fronts and experience considerable difficulty due to small holes varying from a pin point in size to ⅛-inch across. These holes do not appear on the extreme surface, but after the castings are filed down about 1/32 *inch they show up. Some times they fail to show up when filed, but after a months time they break out on the surface like blisters or perhaps it appears more as though something under the surface like a pin point had pushed up and broke out a piece of the casting. Upon digging into this place with a pointed instrument, we find a powdery substance as though a chemical action of some sort had taken place at that spot. As these castings are right outside the body the result is disastrous. Can you advise us of the cause of this trouble?*

In the case of crucible melting, a number of additions to the charge have to be made, and it sometimes happens that the pot is forgotten for a time because of the pressure of other duties, and the metal gets hot, above a blood red: the maximum temperature that should be allowed, at anytime during the melting period. When aluminum is overheated, in contact with carbon it may form nitrides and carbides which enter the mold. Carbide in contact with water acts like calcium carbide, except that instead of giving off acetylene gas, methane is formed. Some of these particles get enclosed in the aluminum just below the surface. They get damp as time passes and the gas accumulates around the little speck until it gets strong enough to blow out a piece of the solid aluminum itself. The reaction also forms hydrated alumina.

The small holes near the surface easily uncovered by the filing are due to absorbed gas, probably hydrogen, also possibly the aluminum nitride that has been formed may touch the damp mold, create a puff of ammonia and be driven back into the body of the metal a slight distance to there be enclosed leaving the larger holes.

The remedy is to use greater care in melting. Keep aluminum alloys below 1700 Fahr. when melting for sand castings, and pour as low as possible and still get perfect castings. It is also advisable where much aluminum is cast to install small aluminum melting kettle, and never permit the metal to attain more than a blood-red heat. Also if scrap metal covered with heavy oils is used, it pays to have them washed with gasoline. The heavy oils carburize and work harm. The trouble in this case is caused by overheating the aluminum.

Q & A

Borings May Be Used

We make and machine all of our bronze castings. We have two grades, one containing 90 *per cent copper and* 10 *per cent tin, and the other* 80 *per cent copper,* 10 *per cent tin and* 10 *per cent lead. We accumulate a considerable quantity of borings and turnings and want to know how to use them. Can we put them in our mixtures, and in what percentage? A coke-fired, natural draft, crucible furnace is used.*

Borings and turnings are used to good advantage. First you will have to remove the iron with a magnetic separator. Run the material through the machine several times. Manufacturers of such machines may be found in the advertising columns of The Foundry.

After the turnings have been freed from iron, they may be melted. Fill a pot half full of heavy pieces of the proper alloy and get it hot. Add some turnings or borings, but not enough to chill the molten metal. Cover with charcoal and reheat to about 2400 degrees Fahr. Add scrap and gates, reheat and pour.

If you have a large accumulation, it may be advantageous to melt it down and cast it into ingots. In that case, get a small bath of liquid metal in the pot. Add as much borings and turnings as the metal will carry without chilling, and reheat. When again liquid, add more borings and reheat. Repeat the process until the pot is full and pour into ingot molds.

If you make up your alloys from new metals, the procedure is slightly different. Put a small amount of borings in the bottom of the pot to act as a cushion for the copper ingot. If the ingots tend to protrude above the top of the pot, use a deepener. That is an old crucible with the bottom removed which is set on top of the pot. By using a deepener the whole charge can be put into the pot and melted down at once. In that case, the charge will consist of borings, copper ingot, return scrap, etc.

Q & A

Core Crushes Easily

Can you give us any information on a flexible core for nonferrous work? It seems to me that an article published some time ago referred to a core binder that would promote this condition.

Your inquiry seems rather odd in that you desire a core that is flexible when usually the thing desired in a core is firmness until the metal sets. However, we assume that you mean a core that will crush easily when the metal contracts. Some brass foundries use rosin as a core binder in small cores. This will give necessary stiffness until the rosin becomes heated. Then the core will soften and be more or less flexible. Easily crushed cores may be produced by careful attention to the quantity of binder added to the sand. Add only enough to hold the sand together. Use the least amount which still will allow the core to be handled when baked. This will apply to any binder employed. One firm making aluminum nozzles for vacuum sweepers used a dry binder and old molding sand. The binder was as weak as could be employed, and just before the cores were baked they were sprayed with molasses water. The cores were fragile, but prevented cracked castings which previously had caused trouble.

Some time ago the bureau of standards experimented with rubber binders for sand cores. The rubber is milled or smoked sheet in the proportion of 1 pound of rubber to 1 gallon of aviation gasoline. The binder was used in the proportion of 92 sand and 8 binder. Drying is done in air, and ample precaution must be taken due to the inflammability of the binder. The cores may be rammed by any method, and it is said that the mixture is not sticky and does not stick to the core box. The cores must be rodded as in green sand cores. Drying from 2½ to 3 hours develops practically full strength. More detail on the work done by the bureau will be found on page 892 in the Nov. 1, 1928 issue of The Foundry.

BILL

By Pat Dwyer

Hears About Haman and Linings

SAY," said Bill the other night "who was this here guy Hayman?"

"Hayman?" I naturally inquired. "The name does not found familiar. Are you sure you are not thinking of Big Bill Haywood the stormy labor petrel of Colorado and Coeur D'Alene in the early years of the present century? He went to Russia many years ago and died there shortly afterward." "No. I knew Bill. Opinions differ on his views and methods, but in a rough and ready manner he had a noble flow of language. The last time I heard him, he was addressing a hall full of striking miners and before he was through he had lifted the whole gang to the emotional shouting stage." However, that has nothing to do with the question before the house. This bird Hayman must have been somebody or done something out of the ordinary. Every once in a while his name pops up like a bubble in a swampy pool, and then disappears just as casually. Surely you have heard the expression, 'hanged as high as Hayman?' Who or what was he and why and where was he hanged? Why has this hanging been singled out from all the hangings that have taken place since the world began?"

"Your pardon, dear lad," I said, "I thought you were talking about a man named Hayman."

"I *am* talking about a man named Hayman!"

"The error," I admitted, "partly is mine and partly is due to our English language in which two or more words with the same pronunciation are spelled differently. I thought you were referring to a gent—to me unknown—who spells his name Hayman. Your further reference to the hanging incident clears up the misunderstanding. The man you have in mind is Haman—H-a-m-a-n—a particularly disagreeable character who flourished at the time and in the court of king Ahasuerus."

"And who was this king An-An-Oh, let's call him Andy, for short. What did this skunk do to Andy?"

"He did not do anything to Andy—directly. He committed the unpardonable and for him unfortunate error of attempting to high hat the queen's cousin. The cousin told the queen and the queen told the king.

" 'There, there Pettie,' says Andy. 'Run away now and play. This bird wants to be elevated. I'll elevate him, and how!' Yeah, just like that.

The King Was in the Garden Counting All His Honies. Can't You Take a Joke

"Chuckling right merrily over this neat little quip, he gave the high sign to the royal executioner and that worthy citizen blithely slipped a running bowline over Haman's neck and jerked him to the top of a gallows."

"Apparently," Bill said, "Andy was a pretty tough baby, but inclined to listen too readily to a domineering queen."

"I regret to say," I said, "you are doing this excellent gentleman a grave injustice. Personally, I always have admired him. Even to a greater degree, I have admired his beautiful and winsome queen Esther. She is my first choice among all the ladies mentioned in the Old Testament."

"The Old Testament? Did you say the *Old* Testament? For the love o' Pete when did this story happen, and," suspiciously, "how come you are so familiar with it?"

"The exact date is of no material importance. The various characters have disappeared as completely as the smoke of their sacrificial fires. Their cities lie buried under the sands of the desert blown down by the wild winds that for centuries have wailed a requiem over their last resting place. In a word, my lad these people are all quite dead.

"When I was a young gossoon at my mother's knee, she invariably commenced all her stories with the preamble. 'Once upon a time that was longer ago than I could tell you, and twice as long ago as you could tell me.' I can remember to this day the delightful anticipatory thrill evoked by these words, even though I knew in advance the story that was to follow. I can see myself—" "Me too," Bill interrupted rudely, " I can see you sitting there like a young half fledged bird, all eyes and ears and long neck with your mouth half open as if you expected to have a worm dropped into it. Lay off the reminiscences and get into the story—if there is a story, which I am beginning to doubt." "Certainly," I said, "There is a story. One of the finest stories ever written. I have read it several times and that acounts for my familiarity with the various incidents. The story has everything a real story should have. The big boss, the beautiful heroine, the dirty villain, the splendor and magnificence of a king's court, underhand plotting, unmasking of the villain, virtue triumphant in the last act and they all lived happily thereafter.

"Barring a few local touches and the absence of the telephone, telegraph and the radio, the story might have been written yesterday. Apparently human nature never has changed. Pride, covetousness, lust, gluttony, envy, anger and sloth are not modern sins. Love, hate, jealousy, lust of power and prestige have caused dynasties to rise and fall. Black murder and sudden death were known to the ancients and—when the occasion arose—they—the ancients, to wit—exacted vengeance, swift, sure and terrible in a manner beautiful to behold. No pussy footing, dilly-dallying or waiting for due process of law. An aggrieved gentleman fell upon his enemy like a half starved wildcat and just naturally clawed him to ribbons."

"My word," Bill exclaimed, "that sounds like the real old raw head and bloody bones stuff. I take it that old boss Andy was right handy with the claws."

"Handy with the claws? He was handy with everything. In fact you might say he was the original, dyed in the wool handy Andy. Tough, hard, quick on his feet, with his crown cocked over one eye, he was

THE BOSS. The queen, Vashti, found that out when she tried to put a fast one over on the old boy."

"I thought you said the queen's name was Esther?"

"Esther came later. Vashti was queen when Andy staged a magnificent entertainment in honor of visiting rulers and princes from all the provinces between India and Ethiopia. According to the custom of the period, Andy held a stag party in one palace while the queen entertained the ladies in another.

"As a final treat for the boys and as a fitting cap sheaf to the display, and magnificence of his court and appointments, Andy sent word to the queen to step in for a moment decked out in all her splendor. Vashti haughtily replied that the king could take a long running jump in the lake."

"Ah," said Bill. "The well known irresistible force and the immovable object. How did the problem work out in this instance?"

"Just about in the usual manner. The queen gained her point but she lost her job. The king gained his point, but he lost a queen. As he explained to the paymaster, 'You can't let 'em get away with that kind of stuff. Give her a check for an extra month's pay and if she does not like that she has my gracious permission to jump in the lake. Masculine supremacy must be maintained.' "

"Now I know," Bill sighed, " Why men refer to the good old days."

"With Vashti out of the way, the king issued a general proclamation to have all the beautiful maidens in the country brought before him, that he might choose a successor. They all came, old and young, fat and lean, short and tall, blonde and brunet, bowlegged and straight, hump backed and pigeontoed, jingling with rings and bracelets and each one confident, after the fashion of women, that she was a vision of delight. One of the most pathetic sights with which I am familiar is that of a vapid face flapper gazing with the most earnest delight at her reflection in a handbag mirror."

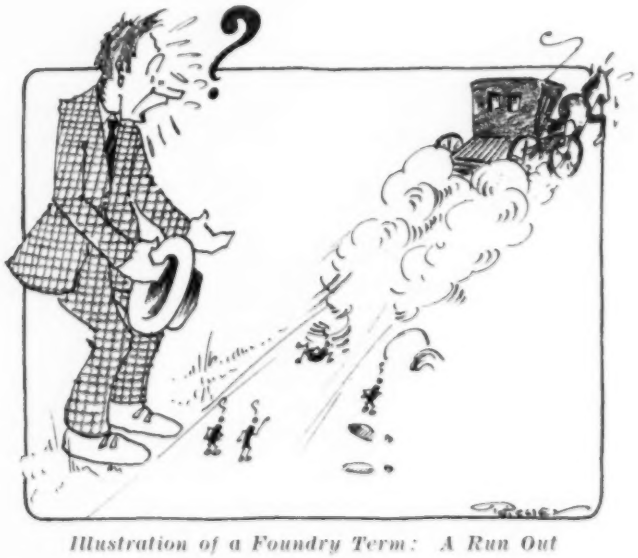


Illustration of a Foundry Term: A Run Out

"Ain't it the truth, dearie? Push on."

"The greater part of the mob was eliminated in the preliminaries outside the gate. The half dozen winners were brought before the king and he immediately selected Esther, a beautiful, orphaned Jewish girl who had been brought up by her elderly cousin Mordecai. As she approached at the king's command, he noted with approval the graceful carriage, the free and buoyant step of youth, the hint of delicately rounded feminine curves under the flowing dark red robe that harmonized with the scarlet lips, the faint tinge of rose in the satin cheeks and the glorious crown of shining black hair.

"She carried her head proudly, with chin slightly tilted outward but with eyes modestly cast down under their fringes of dark curling lashes. Addressed by the king, she gazed at him frankly from under straight and level brows. Her eyes, large dark and luminous as those of a wild bird reflected a spirit in keeping with her beautiful body. Truth, constancy, courage—" "All right," Bill interrupted, "All right. Cut it short. Just say she was a knockout and let it go at that. I had a girl like that one time and she turned me down, hopped the twig with a smelly bird who ran a livery stable. How did this dame Esther throw the hook into Haman?"

"Haman, in the modern vernacular, was one of the big shots of the city and a frequent visitor at the king's palace. He was accustomed to the bowing and groveling of the populace as he passed among them. Mordecai not only refused to grovel, or even bow, he absolutely ignored Haman's presence. Naturally—again quoting from the vernacular—this fairly burned Haman up.

"Every day honest old Mordecai spent an hour lounging around the palace entrance on the off chance of having a word with his beautiful young cousin, and perhaps for the pleasure of basking in her reflected glory. His people had been brought there in captivity and still were regarded as a subject race. Who can blame him if his heart swelled with pride at the whispered comment:

Haman (the dirty dog) Rises To the Bait

" 'Who is the old bird with the whiskers, talking so familiarly with the queen?'

" 'Why my dear, he is the queen's cousin!'

"While hanging around one day he learned of a conspiracy to put the king on the spot. He promptly reported to the queen and she told the king. 'O.K.' says Andy. 'Hey, Boy. Tell the captain of the guard I want to see him!'

"When the captain appeared, Andy extended a list of names with the left hand and then carelessly gestured with the right. The observant captain noted that the thumb was turned down. Next day the bodies of all the conspirators, neatly suspended by their necks, decorated the outside of the palace wall.

"With all quiet on the western front, the king asked Esther how he could express his gratitude to the lad who had tipped her off. She craved permission to have Mordecai for lunch the following day. As an after thought she asked the king to invite his old friend Haman also.

"After the lunch, Andy cocked one leg over the other and leaned back in his chair with a glass in one hand and a cigar in the other.

" 'Haman, old top,' says he, 'what form of celebration would you suggest for a man whom the king delights to honor?'

"In his conceit Haman took this allusion to mean himself. He modestly suggested that this favored indi-

vidual should be granted a white horse, a royal cloak, a guard of honor fore and aft and a pair of trumpeters to lead the parade as the cavalcade marched down the main street.

" 'Fine work,' says Andy. 'You hereby are appointed a committee of one to arrange this parade for this gallant lad, Mordecai. As a special mark of our royal favor you will ride behind Mordecai and hold up the tail of the royal cloak so that it may not trail in the dust.'

"Outwardly smiling, but inwardly boiling with jealous hate, Haman went through the ordeal. When he arrived at his home that evening he was fit to be tied. Finally he calmed down sufficiently to tell his wife. She promptly fell on the floor in a screeching convulsion and tore up large strips of carpet with her nails. At length Haman pacified her by the promise to exterminate every Jew in the country.

"On the pretext that the Jews were planning an uprising and the promise to pay into the royal exchequer 10,000 pieces of silver, part of the anticipated loot, Haman secured Andy's permission to swing the anti-semitic sword.

"Despite the frantic pleading of Mordecai, pleading based on the knowledge that sudden death was the penalty for approaching the royal throne without a summons, queenly, courageous Esther, sublime in her devotion to her own people, faced the ogre in his den and told him the truth.

" 'What's that?' Andy roared. 'That missbegotten spawn of a cross eyed pig would dare lay his slimy paws on my pet queen? 'Sdeath, odds bodkins and likewise gadzooks, I'll show him who's boss around here!'

"He countermanded the general massacre order and then hanged Haman on the gallows, that thoughtful gentleman had erected for Mordecai. To make the job complete and also as a salutary lesson to other prospective conspirators, he hanged his ten sons with him."

He Gets the Dope

"Well" said Bill. "I often have wondered about the bird Haman and now I know. Nothing like asking a few questions when you want information. I had an inquiry the other day from a lad who said he had been puzzled for several years about the behavior of the lining in his cupola and he finally decided to ask me about it.

"He wanted to know what is the average life of the lining in a 24-inch cupola. Starting with a new block lining he finds the lining gutted back to within 1-inch of the shell after melting four 1800-pound heats. A rammed lining acts in the same manner. He charges 250 pounds of coke on the bed and thereafter 500 pounds of iron and 50 pounds coke. The blast pressure is 7 ounces and the iron at the spout is fairly hot.

"The average lining life of a 24-inch cupola—or of any other cupola—may be computed according to either of two methods, but unfortunately the result in either case can not be quoted as a rule to apply to 24-inch cupolas in general. For example if you take the elapsed time as a base for your calculation, you may find that the lining in one cupola lasted for four years while the lining in another burned through in two days. The explanation of course is that in the first instance the cupola was in blast for 1-hour once a month for 4 years while in the second instance the cupola was kept continuously in blast for 48 hours.

Bricks Wear Out

"The second method based upon the amount of metal melted also is open to misinterpretation. The brick lining in a cupola running long heats will last longer—on a tonnage basis—than the lining in a furnace where the same amount of metal is melted in a greater number of heats. Thus in a 60-inch cupola running 9 hours per day and melting 125 tons, the brick wear will not be as severe as it will be in a similar 60-inch cupola running three consecutive 3-hour daily heats to melt the same amount of iron. The usual brick consumption on long running heats is 1.6 bricks per ton of iron melted.

"Apparently something is radically wrong in the method of operation. The lining in a cupola which is in blast only for approximately half an hour once a week, should last indefinitely. The statement that after the fourth heat the lining is burned back to within an inch of the shell, leads me to wonder if he applies any daubing clay after each heat. Under ordinary conditions the bricks at the melting zone will burn away to a depth of approximately 1 inch during the first heat. When preparing the cupola for the following heat, this depression is filled with refractory material and the surface is slicked off flush with the remainder of the lining. By the time the bottom is dropped this material will all or nearly all have disappeared and the cavity will have to be filled again as in the first instance. By renewing this daubing material each time the cupola is prepared for a heat, the brick lining in a 24-inch cupola melting 1800-pound heats should last for years.

"He does not give the height of the tuyeres, therefore the weight of 250 pounds of coke on the bed carries no significance. A definite thickness of fuel must extend above the tuyeres to insure proper melting conditions. This thickness varies according to the diameter of the cupola, the pressure and volume of the blast and the character of the coke. Starting with 36 inches in this particular instance, he can raise or lower it by degrees until he hits the ideal amount for his own conditions.

"The iron charge of 500 pounds is a little heavy for a 24-inch cupola. Faster and better melting can be secured with 400-pound charges or even with 300 pounds. The same ratio of coke may be maintained unless a drop is noted in the temperature of the iron. Then the amount of coke may be raised a little at a time until satisfactory conditions are secured.

"Coke may be charged by weight after a practical demonstration has showed the proper amount by volume. Thus the best results are secured from a layer of coke between 4 and 6 inches in thickness. Coke varies in weight to a considerable extent depending on the location from which it is derived. Therefore no definite rule can be laid down regarding the proper weight to use. Coke also varies in fixed carbon content. The arbitrary ratio of 1 pound coke to 10 pounds iron presupposes a coke weighing about 32 pounds to the cubic foot and showing a fixed carbon content of nearly 90 per cent.

"The information that the blast pressure is 7 ounces does not contain any real information. With proper piping and blower 7 ounces pressure could be obtained in a 1-inch pipe, but the volume of air would not melt much iron. What is needed is the proper volume to burn the coke in the proper period of time. A 24-inch cupola operated efficiently has a melting capacity of 4000 pounds per hour. This will require the admission of approximately 60,000 cubic feet of air in the same period, or 1000 cubic feet per minute.

"An excellent and comprehensive series of articles on the construction, maintenance and operation of the cupola appeared in THE FOUNDRY commencing with the Sept. 1, 1928 and concluding with the July 1, 1929 issues. These were written by J. E. Hurst and now are available in book form under the title "Melting Iron in the Cupola" and may be ordered through THE FOUNDRY for $5.15."

Appoint Representatives

Manitoba Bridge & Iron Works, Ltd., Winnipeg, Man., operators of foundries, structural and machine shops and rolling mills with sales offices in Calgary, Alta., and Regina, Sask., have been appointed sales representative in Manitoba and Saskatchewan for the Link-Belt Ltd., Canada. Riverside Iron Works Ltd., Calgary, Alta., has been appointed sales representative in Southern Alberta. Those appointments were made by E. C. Burton, vice president, Link-Belt Ltd., Toronto, Montreal and Vancouver.

Harnischfeger Corp., Milwaukee and its subsidiary, the Milwaukee Electric Crane & Hoist Co., have consolidated to economize by eliminating duplication of sales activities.

Gray Iron

Possesses

Valuable Engineering Properties

RESEARCHES of Andrew and Hyman on high temperature growth were published in the Jan. 15, 1927 issue of THE FOUNDRY. The heating range or cycle used by those investigators was from room temperature to 1650 degrees Fahr. The test pieces were held at the high temperature for 15 minutes and then cooled. The objectives of Andrew and Hyman were to determine whether the presence of silicon was a necessary factor for growth; what happens to the graphite at the end of 50 heating and cooling cycles, and whether growth could be eliminated or retarded by the presence of certain carbide forming elements.

Two Stages of Growth

Andrew and Hyman found that growth is always preceded by graphitization; chromium up to 1.5 per cent retards and reduces growth but does not prevent it, and graphitizing elements, silicon, aluminum and nickel increase the growth rate and the total growth. Andrew and Hyman also confirmed Carpenter's observation that growth takes place in two stages. The first or rapid stage is brought about by the oxidation of ferrite and subsequent oxidation of graphite. The second stage is due to slower penetration of oxide into the metal because of the sealing of passages by oxide.

Benedicks and Lofquist, *Journal* of the Iron and Steel institute, London 1927, regard the mechanical factors involved in expansion and contraction as being the principal causes of growth. J. W. Donaldson, *Foundry Trade Journal* Nov. 1, 1928, confirms observations that growth takes place on repeated heatings and coolings below the critical range. His experiments were conducted in the range 60 to 1110 degrees Fahr. However, temperature and time must be sufficient to produce some graphitization, to which the initial expansions are due.

Then air penetrates along the flakes, oxidizing the material and further supplementing the volume. Thus, the amount, size and distribution of the graphite are controlling factors and may be influenced to some degree by proper balance of composition. Low total carbon, fine graphite flake size, high phosphorus, low manganese, and silicon below 1.1 per cent are necessary in irons to resist growth.

Permanent growth of gray iron was discussed before the Chicago section of the American Institute of Mining and Metallurgical Engineers in January 1930, by W. E. Remmers. He regards the graphitization, solution, and regraphitization reactions occuring in passing through the transformation range an important factor in growth phenomena. Oxidation of the metal matrix after the graphite flakes have been burned out has a large accelerating effect on growth. Mechanical swelling causes minute fractures which promote growth. High silicon, aluminum, total carbon and, under certain conditions, nickel and titanium increase growth. Vanadium favors growth. Manganese tends to retard growth, while chromium is quite effective in this direction. Minimum growth is obtained with white irons. Protection from oxidation is desirable.

Reduce Growth

CAUSES of permanent growth may be summarized under five headings which include expansion due to graphitization, corrosion, thermal gradients, allotropic changes, and pressure from occluded gases. To a large extent such growth may be reduced by careful attention to certain factors which are discussed in this article. The twelfth article appeared in the Jan. 1 issue.

Although literature on growth of gray iron is voluminous, it is likely to be confusing to the foundryman or engineer unaccustomed to practical summarization of a mass of research data. The references mentioned in Table XII cover about 75 per cent of the literature of the subject, and through cross reference probably represent nearly all the significant thought on this subject. Before reviewing those data, let us recall some of the fundamentals of the metallography of gray iron. Those were given in more detail in Part II of this series which appeared in the March 1, 1930 issue of THE FOUNDRY.

Gray iron may be considered to be made up of two parts: (1) A metallic matrix, which (2) contains many thousands of scattered graphite flakes. In a gray iron the matrix is composed largely of pearlite (the ferrite-cementite euctectoid) or of ferrite (really silico-ferrite) or of an admixture of pearlite and ferrite. In irons containing an appreciable amount of phosphorus, there is another component known as steadite. If the phosphorus content is high, steadite often forms a sort of network throughout the metal.

Flakes Not Continuous

The graphite flakes, which are soft and porous vary in amount, size, and distribution according to the kind of gray iron, its treatment, the size section, etc. The flakes break up the coherence of the matrix, but (except in possible and rare cases) do not form continuous paths through the matrix. Other conditions equal, increased silicon, higher total carbon, and slow cooling rates usually promote the formation of larger amounts of coarser graphite flakes. White irons are composed of massive cementite plus pearlite (or austenite, in exceptional cases), with no graphite flakes. Mottled irons are intermediate between gray and white irons.

Under certain conditions some gray irons are not solid throughout, containing parts which have porosity due to shrinkage effects. Such porosity may be evident as actual, jagged shrinkage cavities, or it may be incipient—that is to say just beginning or about to be—in which case it may be distinguished only with difficulty even under the microscope. The significant point is that porosity either gross or incipient, offers continuous passages through the parts so affected. Gray iron itself is not a ductile material, even slight distortions may result in fracture, generalized or localized according to the degree and nature of the distortion.

Causes of permanent or irreversible *growth* in gray iron may be summarized under the following head-

ings: Graphitization expansion; corrosion; thermal gradients; allotropic changes (involving expansion and contraction), and pressure from occluded gases (this point is disputed by many). These factors generally act in an interdependent manner, and most of them are progressive and mutually cumulative. For convenience in exposition three types of cycles of heating and cooling will be considered: Below any ordinary graphitization range, say to 700 or 800 degrees Fahr.; within range of graphitization, but below the allotropic modification, say 900 to 1300 degrees Fahr. for ordinary gray irons, and through and above the allotropic modification range say 1325 and 1340 degrees Fahr. and above.

Within the first temperature range graphitization expansion, and allotropic changes are not involved. For example, in Piwowarsky's work, samples heated in rapeseed oil (thus protected from corrosion) up to 570 degrees Fahr. showed no growth. However, when heated in steam, growth took place, and at 660 degrees Fahr. there was corrosion even to the interior of the coarse grained bars. The fine grained irons did much better. That is the general experience of users of valves, piping and fittings for superheated and higher pressure steam. With dense sound castings and good design, growth may not be a serious factor up to 700 or 800 degrees Fahr. If either porosity or open grain allows penetration of oxidizing gases there is trouble ahead.

Greater Volume Occupied

Therefore, corrosion is an important factor in this range as the products of corrosion occupy greater volume than the original metal. Just as in use of cast iron for chemically corrosive service, the dense sound irons are best. In case of chemical corrosion (from liquids) the actual rate of attack on the surface exposed to the corroding media may be as rapid in case of the fine grained material as it is with the coarser grained. However, after the initial of surface attack in the former case the dense grain prevents penetration and slows down further action. The mechanism of that action will be explained more in detail in a article which will appear later.

Existence of thermal gradients promotes cracking. For example, the outer layers of a piece being heated come up to temperature faster than the interior, and consequently are expanded more until uniformity of temperature is reached. That action results in stresses which are likely to cause cracks. On cooling the rapidly contracting exterior tries to compress the still expanded interior resulting in more stresses and more cracks. In case of heat treated tool steels the piece may be cracked into small pieces.

Since gray iron is a relatively nonductile material, even though visible cracks may not be evident, certain rates of cooling and heating undoubtedly result in formation of many incipient cracks. These cannot knit together and actual growth may be traced to this cause. Furthermore, the cracks also allow better chance for infiltration of corroding media. Expansion of graphite flakes and of occluded gases possibly may result in localized stresses and incipient cracks.

In the second temperature range, we have all the factors operative in the first range, intensified in many respects by the increase in temperature range. Perhaps the only ameliorating factor is the increased plasticity or ductility of the metal in the higher temperature range. However, a new factor, graphitization, is present. The thermodynamically stable condition of the iron-carbon alloys in the gray iron range is ferrite-graphite. Pearlite is unstable, as it always is ready to break down to graphite and ferrite which occupy far more volume than the original pearlite.

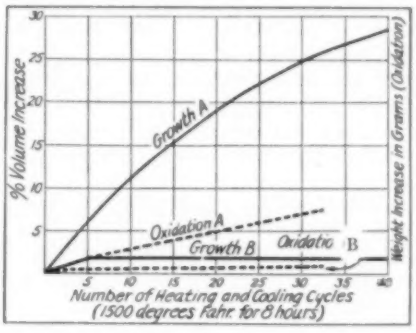


Fig. 82—Comparison of Growth and Oxidation between Ordinary Gray Iron, and Alloy Iron

Below 800 degrees Fahr. the rate of change of pearlite to graphite and ferrite is so extremely slow that it is not of practical importance. There are some evidences of graphitization at 900 degrees Fahr. and from that point on there is a rapid increase in rate concurrent with increase in temperature. Above the transformation range 1340 degrees Fahr. there is some reabsorption of graphite, which increases with increase in temperature. Consequently, in the range from 900 to 1300 degrees Fahr. the rate of growth increases with temperature because of the graphitization.

At 1340 degrees Fahr. or in that vicinity an allotropic change occurs which involves a marked volume change. At that temperature the pearlite-ferrite mixture (alpha ferrite and cementite) changes to austenite (gamma ferrite and dissolved carbide). The volume change occurring in castings with thermal gradients may produce incipient fractures quite readily. Further, most of the other factors promoting growth have their actions intensified with the higher temperature. Corrosion rate is increased, graphitization is much more rapid, and pressure from possible occluded gases increased. Plasticity at the higher temperatures is greater, which may counteract the tendency toward cracking partially.

That in brief summarizes the mechanism of *growth*. How can growth be controlled or modified? Let us consider first the regular (not high alloy) gray irons. Obviously, those possessing the finest grain, the greatest density, the lowest expansion co-efficient, and which are chemically most stable will resist growth best. Controlling or controllable factors are:

Graphitization. White iron containing no graphite is graphitized with much greater difficulty than gray iron which usually is partially graphitized. Silicon, promoting graphitization, increases growth. Other elements such as aluminum and nickel promote growth. However, substitution of nickel for silicon may diminish growth as nickel is a less powerful graphitizer and its graphitizing reaction stops at the eutectoid ratio or thereabouts. Silicon in the silico-ferrite apparently is readily oxidized to silica (SiO_2).

Chromium Retards Growth

Chromium, because of its ability to effect carbide stabilization, is one of the most effective elements for retarding growth. (Tungsten and molybdenum quite likely have a similar effect). Manganese and sulphur in themselves are carbide stabilizers, but one neutralizes the other. High sulphur and low manganese, and the converse appear desirable. High phosphorus, forming steadite envelopes, retards penetration of corrosive agents, and hence is beneficial in retarding growth. Low total carbon irons, if fine grained and with stabilized carbide can be expected to be more growth resistant than higher carbon irons.

Dense grain, effected by superheating, correct composition, and proper cooling rate, etc., is desirable. Good molding practice, hot iron, good feeding to produce really sound castings are necessary. Care in design will do much to avoid trouble from thermal gradients. Heavy sections are likely coarse grained, and certainly are likely to have thermal gradients. Nonuniform section cause thermal gradients, internal stresses, and trouble. The case for occluded gases does not seem to be proved to the satisfaction of all. It is possible to avoid the allotropic transformations by the use of high alloy irons.

A possible practical answer to the question of prevention and control of growth of gray iron lies in employment of special high alloy irons of the austenitic type. Such irons are commercially obtainable through the employment of high per-

centages of nickel, accompanied with smaller percentages of copper and chromium. Irons with 15 per cent or more nickel are gray in fractures, containing free graphite, just as do ordinary gray irons. However, the matrix is largely austenitic, rather than the pearlite-ferrite mixture usually found in gray irons.

The austenitic matrix indicates the absence of the usual transformation range changes, hence freedom from the dimensional changes occuring in this range. The addition of copper, 4 to 6 per cent, and chromium, 0.5 to 2.0 per cent, materially enhances the ability of the material to resist corrosion and scaling influences, which increased resistance, probably lessens the dangers from surface checking and penetration of gases. The presence of chromium also possibly further stabilizes the retention of carbon and tends to minimize further graphitization.

Are More Costly

This resistance to growth is illustrated in Fig. 82, taken from a paper presented by Vanick and Merica before the American Society for Steel Treating, September, 1930. The authors claim that the metal designated B in the curve, which contained 14.31 per cent nickel, 5.31 per cent copper and 5.23 per cent chromium, 1.62 per cent silicon, and 3.04 per cent carbon, resists growth in either oxidizing or reducing gases of which carbon dioxide steam, carbon monoxide, illuminating gas, and regular furnace gases are examples. The ordinary iron A contained 2.02 per cent silicon and 3.26 per cent carbon.

These high alloy irons usually are more costly than gray iron, due to the high alloy cost. However, if properly made, they are cast and machined without trouble. Where machinability is not a factor and white iron structure not objectionable, higher percentages of chromium can be used successfully. Such percentages usually range from 5 to 25 per cent.

This is the thirteenth of a series of articles on engineering properties of gray iron. The twelfth appeared in the Jan. 1 issue, and the fourteenth will appear in an early issue.—THE EDITORS.

Pittsburgh Foundrymen Discuss the Cupola

Discussions on the recommendations of the American Foundrymen's association subcommittee on cupola operation more than filled the program at the January meeting of the Pittsburgh Foundrymen's association, held Jan. 15. Time was not available for the consideration of all of the recommendations and it was decided to continue the discussion at the next meeting, to be held Feb. 16.

Dr. Edward E. Marbaker, vice president, Industrial Research & Engineering Co., Pittsburgh, and a member of the subcommittee on cupola operation of the American Foundrymen's association, led the discussion. It generally was agreed that a coke bed of 30 inches above the tuyeres is preferable to the 40 to 50 inches recommended by the subcommittee. The subject of use and type of flux brought out considerable discussion.

Talks Over Radio

G. H. Clamer, president, Ajax Metal Co., Philadelphia, delivered a radio address Jan. 22 on the part that nonferrous metals play in the industrial structure of the United States over the National Broadcasting system. The speech was broadcast throughout the country and was sponsored by the Nonferrous Metal institute.

Book Review

Atlas Metallographiceus, by Hanemann and Schrader, Sections 3, 4, 5, 6, 7, 8 and 9, paper, 7½ x 10¾-inches, 48, 32, 32, 32, 32, 32, and 48 pages respectively, published by Gebrueder Borntraeger, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, for $14.50 for the seven sections.

The seven sections mentioned are a continuation of a monumental work undertaken by Hanemann and Schroeder several years ago on the metallography of iron and steel. The first two sections described the various structural components such as ferrite, cementite, etc., and presented micrographs to show the structures of plain forged steels of various analyses. Part 3 deals with the order of structural formation and the effect of annealing on structure formation and the whole structure. In addition to the text matter, 47 excellent micrographs with tables giving data on composition, type of material, and the formations shown are included. Part 4 contains 42 micrographs with descriptive matter on primary and secondary structures in unannealed steel; some structural formations in unannealed steel castings, etc.

Part 5 contains 54 micrographs with explanatory tables on the Widmannstaetten and coarse structures, etc. Part 6 contains 64 micrographs relating to various structures with data on the origin of network structures, secondary globular structures, etc. Part 7 contains 61 micrographs with data on the influence of heating speed with recrystallization on the net size; influence of annealing duration and temperature on the net size; structural formation of steel under the influence of carbon content and cooling speed, etc. Part 8 contains 64 micrographs and is a continuation of Part 7. It also includes data on the influence of cooling speed on the size

Table XII

Literature on Growth of Gray Iron

Year	Author
1791	T. Beddoes
1904	Outerbridge, *Transactions*, A. I. M. E.
1909	Rugan and Carpenter, British Iron and Steel institute
1910	Hollis, American Society of Mechanical Engineers
1912	Rugan, British Iron and Steel institute
1913	Messerschmitt, *Giesserei Zeitung*
1916	Carpenter, British Iron and Steel institute (Staffordshire branch)
1917	Moldenke, *Principles of Iron Founding*
1918	Hurst, British Iron and Steel institute
1918	Whitely, British Iron and Steel institute
1920	Okochi and Sato, Tokyo Imperial university
1922	Campion and Donaldson, Institute of British Foundrymen
1922	Kikuta, Tokyo Imperial university
1922	Durand, *Comptes Rendus*
1923	Asch, *Zeitschrift fuer technische Physik*
1924	Andrew and Hyman, British Iron and Steel institute
1924	Andrew and Higgins, British Iron and Steel institute
1925	Richman, *Foundry Trade Journal*
1925	Oberhoffer and Piwowarsky, *Stahl und Eisen*
1926	Kennedy and Oswald, American Foundrymen's association
1926	Honneger, *Giesserei Zeitung*
1926	Smalley, American Foundrymen's association
1926	Piwowarsky, American Foundrymen's association
1926	Pearson, Carnegie Memoirs
1926	Higgins, Carnegie Memoirs
1927	Matsuma, *Foundry Trade Journal*
1927	Sipp and Roll, *Giesserei Zeitung*
1927	Coyle, American Society for Steel Treating
1927	Hurst, *Foundry Trade Journal*
1927	Schwimming and Flossner, *Stahl und Eisen*
1927	Andrew and Hyman, THE FOUNDRY
1927	Benedicks and Lofquist, British Iron and Steel institute
1928	Donaldson, *Foundry Trade Journal*
1928	Piwowarsky and Eiser, *Die Giesserei*
1930	Remmers, American Institute of Mining and Metallurgical Engineers

of ferrite crystals in net structures, the formation of cementite nets and pearlite in hypereutectic steel, etc. Part 9 contains 64 micrographs with descriptions of the change of cementitic and pearlitic forms. The micrographs show the transformation of coarse structures into fine structures through recrystallization; examples of the transformation of pearlite and cementite in gamma mixed crystals by heating, etc. In addition Part 9 contains an excellent index reviewing the data presented in the nine sections.

Executives Are Former Apprentices

By E. H. Ballard

DURING the war the General Electric Co. had no indentured foundry apprentices, and as the company had been forced for many years to train unskilled help for miscellaneous molding and coremaking operations, a shortage of help of this character was experienced. A number of married men beyond the draft age were secured and the company agreed to teach them molding and core making, paying them a wage higher than that usually paid unskilled help and gradually increasing their wage as they progressed.

Today it is surprising to look about the company's foundries and see the large number of employes who were trained under these conditions and who still remain, doing some of the best work. This does not apply to machine molding but only to miscellaneous floor work. Those men in reality served an abbreviated apprenticeship.

Maintain Two Groups

However, foundrymen believe that a youth in his teens, under proper guidance, would develop naturally into a better workman. The General Electric Co. believes that and it is backing up this belief. The company has trained a number of boys during the past four years and has eight now in training. It also employs a number who have completed their apprenticeship.

College graduates who have been selected to serve an apprenticeship of 2½ years constitute another worthwhile group. Although not indentured, they serve under an agreement which the company has made with them. One of that group is now assistant superintendent of the steel foundry. Another resigned recently to accept a position as superintendent of a steel foundry after being in our employ for six years. Another is chief melter in a foundry producing electric steel castings in another branch of the company.

The General Electric Co. has maintained extensive courses in its various works and has graduated many hundreds of boys, most of whom were in the mechanical and pattern-making trades. During this period 1167 apprentices were graduated, 50 per cent of whom still are with the company. From these graduates we have developed 3 managers, 28 engineers, 8 superintendents, 8 supervisors in industrial training, 40 graduates teaching in public schools and colleges throughout the country, and the company's manufacturing plants are absorbing apprentices as fast as they graduate. At present there are 200 boys in training at the Lynn, Mass., plant.

Needs Trained Men

FOR many years the General Electric Co. has had an elaborate system of apprentice training but it is only within the past 4 years that foundry apprenticeship has been actively incorporated in the program. This article which is abstracted from a paper presented at the Cleveland convention of the American Foundrymen's association, shows the success which has attended the efforts of that company in producing trained foundrymen. The author is superintendent, pattern shop and foundries, River works, General Electric Co., West Lynn, Mass., and vice president, American Foundrymen's association.

Many years ago, a half-hearted attempt was made to train boys in the foundry. A few graduated. The first one to graduate went West shortly after and later became interested in the foundry business and has done well financially. For many years thereafter interest waned, but about four years ago, when the importance of training foundry apprentices was being stressed, a group of 12 boys in the gray iron foundry at Lynn was placed under the leadership of a good molder.

Of the graduates from this group, one is acting as assistant foreman of the main molding floor and another is on time study work, while three others are doing some of the best work on the molding floor. Another left the course after 2 years, went to a foundry trade school, returned after graduation and is now assistant foreman in the light gray-iron foundry.

The company has been so well pleased with the character of the boys who graduated that it transferred a graduate apprentice from one of our other plants and employed still another from a well-known local foundry when the graduates of the General Electric Co. did not fill its needs. Both have done some valuable time-study work. One now is acting as assistant foreman in the gray-iron foundry and the other still is engaged on regular time-study work in the steel foundry.

We sometimes hear men of intelligence ask the question, "Why train apprentices today in the foundry when machine methods destroy the opportunity to absorb the graduates?" My answer is that if we ever needed men of mechanical ability and practical training in the foundry, we need them now.

Competition was never keener than at the present time. New processes are making inroads into the foundry industry and call for keen, intelligent men to raise the standards of the foundry in every particular and place it in its proper place in the manufacturing group.

After all, in our basic industry the manufacturing cycle usually begins with castings. If we can, by using intelligent methods, produce a product which is superior to that which was in times past the source of so much trouble and economic loss, we shall at least have made our contribution to the progress of the age.

Costs Are Discussed

John L. Carter, Sacks-Barlow Foundries Inc., Newark, N. J., and chairman of the cost committee, Gray Iron institute, Cleveland, addressed the regular monthly meeting of the Philadelphia Foundrymen's association of foundry costs. The meeting was held at the Manufacturers' club, Philadelphia. A lively discussion, following Mr. Carter's talk was led by Charles A. Klaus, Newark, cost expert, Gray Iron institute.

Hercules Powder Co., Wilmington, Del., is completing its new experimental laboratories to house the research facilities of the company.

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ Half a Cent Off

RECENTLY a tale has come to light which if not true, at any rate, sounds plausible enough to be a gospel fact. It is said that a certain foundry making sash weight castings sent a limited shipment to a contractor who maintains a small warehouse stock of buliding materials. This contractor suddenly failed and the shipment was left standing on a freight siding while the shipper was notified and demurrage charges started mounting. The foundry is said to have called a large hardware interest in that city and, being connected with the purchasing agent, offered him the shipment of sashweights for the freight and demurrage charges. The response of the purchasing agent was: "Your price is a half a cent a pound too high."

CONDITIONS are particularly ripe, with the first rosy pink light of returning prosperity showing over the horizon for just this sort of squeeze play. All of the accumulated stories of lower prices, the evidences offered in news stories and vague rumors will be used to hammer prices. Now as never before, every foundry needs the protection of an adequate, accurate and dependable cost system. Every quotation should be measured against this cost system and no prices offered which do not square with cost plus a reasonable profit.

¶ Leads to Misconceptions

IN THE mad scramble for a little free publicity in the news columns of the daily newspapers, press agents in the past have been accused of having but faint regard for the truth. However, that condition has been corrected to a large degree, and now even in the most blatant publicity puffs, a fairly strict adherence to truth is maintained. Usually, in most cases those upon whose decision rested whether the material should or should not be published, had a sufficient background to distinguish the correct from the incorrect.

ALTHOUGH the newspaper staffs contain men and women familiar with many fields, it hardly can be expected that their knowledge of metallurgy or science is more than general. Therefore, it is not unusual to see statements on those subjects which are exaggerations to say the least. The layman accepts the statements at their face value and forms misconceptions that are hard to eradicate. While many of such statements may be due to the broad interpretation, or the innate desire of the reporter to include his own ideas, others apparently emanate from the publicity departments of societies in the throes of their annual meetings. It would be expected that the latter would prepare their statements with care.

FOR example, a newspaper clipping mentioning a session of a national organization, refers to the growth of cast iron, and means for preventing or stunting that growth. That is all right but it includes the statement: "Large castings have been known to grow as much as three inches within a year." Nothing was said about the conditions under which cast iron will grow —that is elevated temperature, superheated steam, etc., and consequently the average reader jumps to the conclusion that cast iron grows slowly but surely under ordinary conditions. Indeed some may go as far as inspect the furnace to see whether it has outgrown its basement quarters, or the automobile engine is being hampered by the hood.

EVEN though cast iron will grow under certain conditions, it seldom is subjected to such conditions, especially in the case of large castings. Therefore, if the growth of three inches is a statement of fact, it is one of the rare and unusual cases that occasionally do occur, and some indication of that fact should have been included. It is through such misstatements or half-truths that products may be held in low esteem by many. Foundrymen, whether engaged in gray iron, steel, malleable or nonferrous castings production, must be constantly alert to spike any propaganda which misrepresents their products.

¶ Happy Days for Brass

ADVANCE production figures issued by the biennial census of manufactures shows a total value of nonferrous metals and alloys produced during the calendar year of 1929 as $908,152,427. Compared with the last previous census of $581,568,767 in 1927, this gives a gain of $326,583,660 or an increase of 56.2 per cent. The percentage gained by nonferrous metals and alloys is the largest of the 29 commodities upon which the department of commerce has issued preliminary figures. Of the remainder, ranging from acids to wire products and wood pulp, 10 show a varying percentage loss. Apparently nonferrous business is looking up.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

BEN R. MAYNE, formerly general manager, Saginaw Malleable Iron division, General Motors Corp., Detroit, has resigned that position to become a vice president, American Malleables division, American Brake Shoe & Foundry Co., Owosso, Mich. Mr. Mayne was associated with the Saginaw company for 13 years as general superintendent, plant manager and general manager. He received his early education in the public schools of Southern Illinois and later attended Illinois State Normal school where he specialized in business administration. Following completion of his courses at the latter school, Mr. Mayne entered the motion picture business, but left that industry to become associated with the government. After 7 years service with the government he became affiliated with the Saginaw Malleable Iron Co. in 1917. Starting as general foreman of one of the departments in the Saginaw company, he worked through various branches of the business until 1920 when he was appointed general superintendent. The company was taken over by the General Motors Corp. at that time and Mr. Mayne served as general superintendent for 3 years. In 1923 he was appointed plant manager and in 1926 was promoted to general manager. In his new position, Mr. Mayne will maintain offices both in Detroit and Owosso and will devote his time principally to the American Malleables plant at Owosso, Mich.

Ben R. Mayne

Rudolph Klatt, secretary, Western Malleables Inc., Beaver Dam, Wis., since its reorganization three years ago, has resigned.

A. C. Carbo, has been appointed works manager, Alexandria Foundry, Machine & Boiler works, Alexandria, La., to succeed A. J. Naquin who died recently.

James Fisher, for the past 14 years foundry foreman and salesman, Tallman Brass & Metal Co., Hamilton, Ont., resigned recently and has organized Fisher & Son, 366 Wilson street, Hamilton, Ont., to specialize in brass, bronze and aluminum castings.

S. J. Ellis has retired after being head of the Vulcan Iron Works, Memphis, Tenn., for 24 years. The company has been incorporated by his two sons as Vulcan Iron Works Inc. **William C. Ellis** is president and general manager and **Crockett Ellis** is secretary-treasurer.

Harold S. Falk, vice president and works manager, Falk Corp., Milwaukee, has been appointed a member of the Wisconsin board of vocational education to fill the vacancy caused by the resignation of E. J. Kearney, secretary and treasurer, Kearney & Trecker Corp., Milwaukee.

Luther J. Anthony, Glenwood Range Co., Taunton, Mass., was elected president of the New England Foundrymen's association Jan. 14, at its thirty-fifth anniversary dinner. He succeeded Ernest F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass. Other officers were elected are: **Leroy M. Sherwin,** Brown & Sharpe Mfg. Co., Providence, R. I., vice president, and **George H. Gibby,** Gibby Foundry Co., East Boston, Mass., treasurer. **Fred F. Stockwell,** 205 Broadway, Cambridge, Mass., was re-elected secretary.

Carl V. Dodge has been named manager of roll and steel casting sales of the United Engineering & Foundry Co., Pittsburgh. He succeeds the late William Gardner. Mr. Dodge has been with the company for more than 25 years, starting in the chilled roll foundry department, then located in Vandergrift, Pa., as shipping clerk and later becoming foreman of the cleaning floor and still later order clerk. In 1913 he was transferred to the Pittsburgh office as a steel casting salesman and during the World war was in charge of steel castings sales. With the consolidation of the roll and steel castings sales departments of the company in 1921, he was made assistant manager of sales of the combined departments.

E. E. Klooz, for many years general manager of the Portage Silica Co., and following the merger of that interest with others to form the Industrial Silica Corp., Youngstown, O., has resigned his position as president of the latter organization. Mr. Klooz's long identification with the foundry industry through his activity in promoting better quality in steel foundry sand, sand blast sand, etc., has made him a well-known figure.

E. E. Klooz

Harry S. Ransom has been appointed manager of sales Fort Pitt Steel Casting Co. McKeesport, Pa. After a few years' absence from the steel foundry industry, Mr. Ransom returned last Spring as special representative, sales and engineering department, Fort Pitt Steel Casting Co.

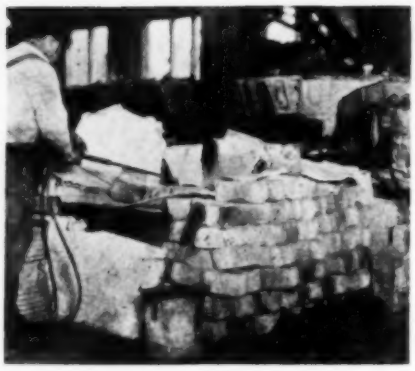
Founders Go to Russia

W. E. Fearn, formerly steel foundry superintendent, Dominion Foundries & Steel Ltd., Hamilton, Ont.; W. D. Hannon, formerly employed in the steel foundry of the American Locomotive Co., Chester, Pa.; William H. McCausland, formerly in the iron foundry of the Bethlehem Steel Co., Bethlehem, Pa.; and Harold V. Peace, Hamilton, Ont., have sailed for Kramatorsky, U. S. S. R., to aid in the instruction of workmen and installation of foundry and steel mill equipment for the Russian government.

Preheats Iron Casting Before Welding

Preheating facilities, necessary in any welding department handling gray iron castings, depend upon the size of work. The most practical and economical method of preheating large pieces, particularly where the entire casting is to be heated, is the use of the temporary firebrick furnace. This is built of loose firebrick laid without mortar. Asbestos paper forms the top of the furnace. The spacing of the bricks around the base of the furnace and hole in the asbestos top assure sufficient draft to raise the piece to the proper temperature. The accompanying illustration shows a preheating furnace of the type described.

The fire must be regulated occasionally while the welding progresses to keep a desired temperature. This is done by opening or closing the draft holes, rearranging the asbestos paper covering, moving hot coals from one place to another, or replenishing the fire whenever necessary. When



The Casting Is Welded Through a Hole in the Asbestos Covering

the casting has reached an even, dull, red heat, an opening is made in the asbestos paper cover just large enough to uncover the weld area. Welding is done throguh this hole.

After the weld is completed, it is important to secure proper cooling. The entire casting should be covered with fresh charcoal and brought up to an even heat. Finished work should be allowed to cool and contract evenly in the dying fire with the asbestos covering intact. It is important that one part does not cool quicker than any other. If this happens the piece may crack.

OBITUARY

C. N. Miller, 82 years old, vice president, Miller Bros. & Sons Ltd., Montreal, Que., died recently.

A. J. Naquin, for the past 25 years works manager, Alexandria Foundry, Machine & Boiler works, Alexandria, La., died recently. Mr. Naquin was 62 years old and was born at Thibodeaux, La.

Frank H. Allen, proprietor, Allen's Foundry, Donaldsonville, La., died recently in that city. Mr. Allen was 71 years old and had spent about 35 years in the foundry business. The business will be continued by Mrs. Allen with Guy Dunning acting as superintendent.

Foundry Association Directory

American Foundrymen's Association

President, N. K. B. Patch, Lumen Bearing Co., Buffalo; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago. Annual meeting, Stevens hotel, Chicago, May 4-7, 1931.

Associated Brass Founders of New England

President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, H. H. Klein, 310 Congress street, Boston. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President, James L. Mahon, American Car & Foundry Co.; secretary, William J. Muhlitner, Great Lakes Foundry Sand Co., 2100 Penobscot building, Detroit. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association

Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. Bull, Assistant Director, C. N. Ring; Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, B. H. Johnson, Florence Pipe Foundry & Machine Co., Florence, N. J.; manager, Arthur J. Tuscany, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill.; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue.

Newark Foundrymen's Association

President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting dates: Dec. 3; Jan. 28; March 25; May 27.

New England Foundrymen's Association

President, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland. Annual meeting Nov. 13 at Columbus, O.

Pacific Coast Founders Association

President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. Truitt, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, C. F. Hopkins, Ajax Metal Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, W. E. Troutman, Duquesne Steel Foundry Co., Pittsburgh; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad City Foundrymen's Association

President, R. L. Eichman, Bettendorf Co., Bettendorf, Ia.; secretary-treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, Horace R. Culling, Carondelet Foundry Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association

President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, J. E. McCauley, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, William Hoppenjans, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, William J. Snyker, St. Paul Foundry Co., St. Paul; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. W. Orphan, Lake Union Foundry Co., 1703 Westlake avenue, Seattle; secretary, Edward C. Gustin, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group

Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

Trade Trends in Tabloid

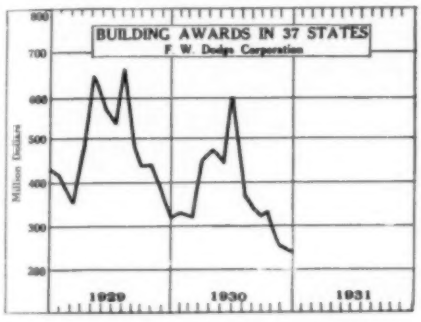
NO GENERAL advance is noted in castings sales, although many report that inquiries are much more brisk and involve greater tonnages than during the last three months of 1930. An increase is noted in automotive jobbing work in both the ferrous and nonferrous classifications.

—T—T—

One of the most encouraging features encountered is the increase in hours of work or number of men employed in those foundry lines which permit manufacturing for stock. This is the first indication of this trend in the past six months.

—T—T—

Gray iron foundry operations in the St. Louis district are slightly



improved, though competition is keen and prices are close.

—T—T—

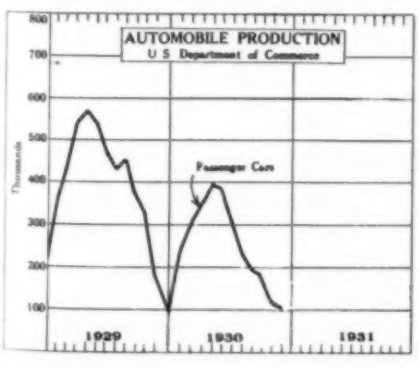
Deere & Co., Moline, Ill. is returning an increasing number of its men to work in anticipation of improved spring business.

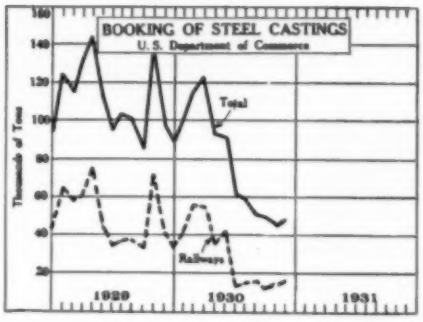
—T—T—

Pig iron purchases have been light, despite the prevailing low prices. Foundry owners, apparently are reluctant to increase their inventory of raw materials until a marked pickup in castings demand develops.

—T—T—

Spotty operations are noted in similar lines of manufacture. General jobbing gray iron foundries in the New England states are operating at from 25 to 50 per cent of normal. Mid-Atlantic foundries in general are slightly more active. The southern states report 40 to 60 per cent, while





a number of jobbing shops of similar class in Canada are maintaining 75 per cent or above.

—T—T—

December building awards declined further in December, when F. W. Dodge Corp. reports the total as $249,935,500 for 37 states east of the Rocky mountains, compared with $316,368,100 for December, 1929.

—T—T—

Anticipated freight car loadings for the first quarter of 1931 will fall 5.5 per cent below the similar period of 1930, according to estimates made by the shippers regional advisory board.

—T—T—

Little improvement is noted in castings inquiry in the New York district. Dullness is reflected by half-time operations in many plants. Some of these have shown a slight increase since Jan. 1, while specialty shops are going slightly better than general jobbing foundries. Conditions

RAW MATERIAL PRICES
Jan. 21, 1931

Iron	
No. 2 foundry, Valley	$17.00
No. 2 Southern, Birmingham	14.00
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.50
Basic, Valley	17.00
Basic, Buffalo	17.00
Malleable, Chicago	17.50
Malleable, Buffalo	18.00
Coke	
Connellsville beehive coke	$3.25 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$12.50 to 13.00
Heavy melting steel, Pitts	13.00 to 13.50
Heavy melting steel, Chicago	10.00 to 10.50
Stove plate, Buffalo	9.00 to 9.25
Stove plate, Chicago	7.75 to 8.25
No. 1 cast, New York	8.00 to 8.50
No. 1 cast, Chicago	9.50 to 10.00
No. 1 cast, Philadelphia	13.00
No. 1 cast, Pittsburgh	12.50 to 13.00
No. 1 cast, Birmingham	11.50 to 12.00
Car wheels, iron, Pittsburgh	13.75 to 14.25
Car wheels, iron, Chicago	11.00 to 11.50
Railroad malleable, Chicago	12.75 to 13.25
Agricultural mal., Chicago	11.00 to 11.50
Malleable, Buffalo	13.00 to 13.50
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	9.75 to 9.87½
Straits, tin	25.87½
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	11.50 to 12.50
Lead, New York	4.75
Antimony, New York	7.37½ to 7.50
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.00 to 4.05

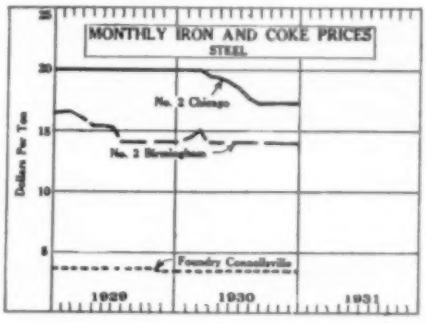
are slow in railway equipment lines, with car and locomotive inquiry virtually at a standstill and no early improvement expected.

—T—T—

Unfilled orders for brass and bronze ingots and billets declined 8 per cent in December, compared with a gain of 10 per cent in November, according to the Nonferrous Ingot Metal institute.

—T—T—

Mid-month foundry operations in the Chicago area were barely 40 per cent. Several jobbing shops, mostly on light work, are pouring four to five days a week with limited working forces. Automotive work has been increasing slowly in western Michi-



gan. Implement and tractor foundries on the whole are on low production schedules. One implement foundry west of Chicago has doubled its shipping instructions for pig iron for the next 30 days, from its original estimates made early in January.

—T—T—

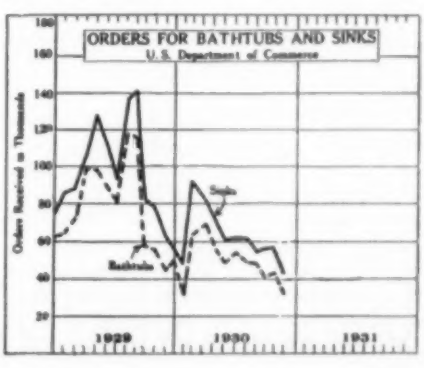
The Prairie provinces of Canada report electrical business fair, good sale of automobile parts and accessories, but steel and machinery business is slow.

—T—T—

Unfilled orders for railroad locomotives increased from 93 in November to 104 in December, according to the department of commerce.

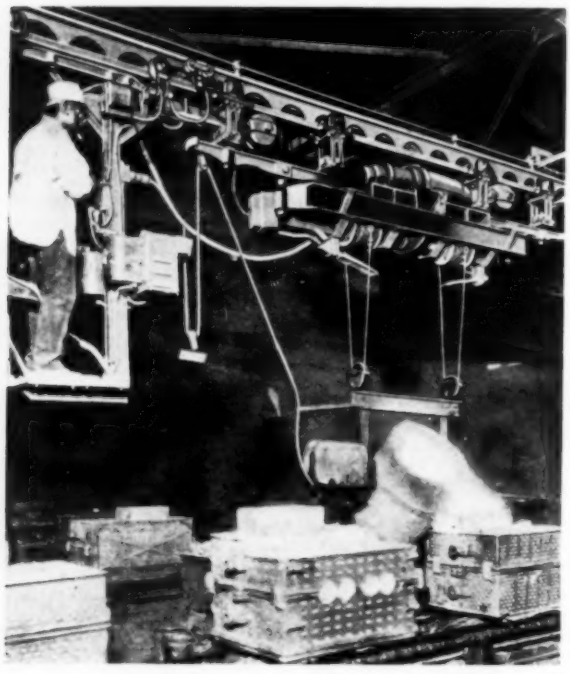
—T—T—

Loadings of revenue freight for the week ending Jan. 3, including the New Year holiday totaled 615,382 cars, an increase of 76,963 over the preceding week.



One Man Handles All Pouring Operations

Cleveland Tramrail division, Cleveland Crane & Engineering Co., Wickcliffe, O., is producing a tramrail pouring unit that may be operated entirely by one man. The unit, shown in the accompanying illustration, is made with a long wheel base so that carrier curves of small radii may be negotiated quickly and smoothly with the assistance of the two wheel motor and trailer heads. Those are of the self-steering type and are equipped with guide roller supports on each side of the track and spring suspended king-pins that swivel on large roller bearings. Track wheels are made of chilled iron and are equipped with thirty-two, ½-inch ball bearings in each wheel, angular races to take the thrust on curves and forced lubrication. The operator is located on a platform at some distance from the hoisting unit.



All Operations Are Controlled from the Platform of the Machine. Two Point Suspension of the Ladle Bail Eliminates Swinging of the Ladle

The hoisting unit is equipped with a twin drum driven from a single motor. That method of construction is said to give uniformity of hoisting and lowering of the ladles and to assist the operator in keeping the ladle in the proper position so that the ladle lip always is in line with the runner boxes on the molds. Double suspension overcomes swinging of the ladle.

The electric tilting device, which is controlled from the operator's platform and which eliminates the necessity of ground assistance in the pouring operation, is a motor driven arrangement of spur gears connected to the ladle bail. It is provided with a throw out mechanism as a protection against motor failure. In such a case, the pouring operation may be performed from the ground. Variable speed control is provided so that the stream may be regulated for large or small work.

Travel speed along the rail is controlled from the operator's platform. A variable speed control is used and rate of travel may be adjusted to from 150 to 600 feet per minute. A foot brake is used in connection with the speed control so that a speed of 3 feet per minute may be maintained while following a conveyor for direct pouring. The higher speeds are used for travel to and from the furnace.

Guard Controls Speed of Swing Grinder

The Black & Decker Mfg. Co., Towson, Md., has introduced a swing-frame grinder with multiple speeds. This grinder has three speed changes and is available with maximum wheel sizes of 12, 16, 18, 20 and 24 inches, and a primary cutting speed of 6000 or 9000 surface feet per minute.

The adjustable steel wheel guard is arranged to make the various speed changes. As the wheel wears, the guard is moved back the proper distance each time which causes the changes in speed to be made. Provided with the guard is an arrangement which prevents the operator from failing to make the speed changes as the wheel wears.

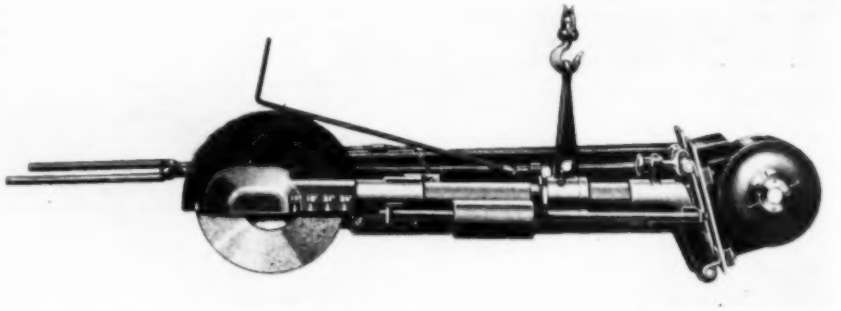
There is a visual device on the guard which enables the shop foreman to tell at a glance whether or not the operator has made proper guard and speed changes to compensate for wear on the wheel. The guard itself is designed to provide maximum safety for the operator. The grinder is ruggedly constructed with a heavy duty ball bearing motor capable of 100 per cent momentary overloads without injury.

Pipe Firm Buys Plant

The Intercontinental Pipe & Mining Co., 122 East Forty-second street, New York, has purchased the property of the former Penn Seaboard Steel Corp., New Castle, Del., for conversion into a cast iron pipe foundry. It is believed that the work of remodeling the plant will be started within 60 days. Unofficial estimates place the capacity of the new plant at 150,000 tons annually. Some time ago it was rumored that the Intercontinental Pipe & Mining Co. was planning to locate in Chelsea, Mass., but apparently that project has been abandoned.

Herbert Kennedy is president of the Intercontinental company in which the Societe Anonyme des Hauts-Fourneaux & Fonderies, Pont-a-Mousson, France, the largest cast iron pipe founder in France, is said to be heavily interested. Marcel Paul, Nancy, France, is chairman of the board. Centrifugally cast pipe made in sand molds will be produced in the new plant, and it will be the third cast iron pipe plant located along the Delaware river. The other two are the Florence Pipe & Foundry Co., Florence, N. J., and the United States Pipe & Foundry Co., Burlington, N. J.

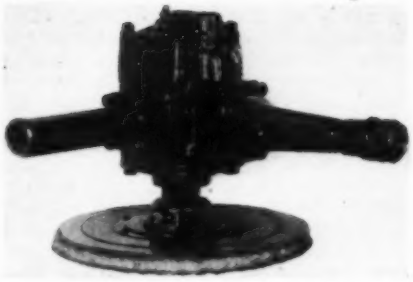
L. W. Greve, head of the Cleveland Pneumatic Tool Co., Cleveland, is president of the National Air Races Inc., a nonprofit group of business men who will underwrite and sponsor the national airplane races in Cleveland for the next 10 years.



As the Wheel of the Grinding Machine Wears Its Speed Is Increased

Sander Is Well Balanced

Independent Pneumatic Tool Co., 600 West Jackson boulevard, Chicago, recently has introduced a new type sander which operates on the pneumatic rotary principle. It is of the center spindle type and is equipped with two handles, is well balanced and is designed to operate with minimum vibration. It may be used in the foundry for general cleaning work. One of its construction features is the operation of the governor which acts in two ways. When the sander is at peak load, the governor automatically opens the throttle and admits the necessary amount of air. When the motor is running idle, the governor decreases the air consumption. That feature is claimed to decrease the wear on moving parts and give long life, low maintenance costs and low air consumption. The speed of that type sander is 4500 revolutions per minute, it weighs 10 pounds without the wheel or disk, and has an overall length of 8 inches. The machine is shown in the illustration.



The Governor Regulates the Air Supply to the Machine

Standards Are Issued

The Manufacturers Standardization Society of the Valve and Fittings Industry recently issued the 1930 edition of its standard, SP-10, covering bronze screwed fittings for 125-pound steam pressure. The publication may be obtained for $1.50 a copy from that organization, or the American Standards association. The Manufacturers society also has issued a new standard, SP-11 covering bronze screwed fittings for 250-pound steam pressure which may be obtained for 50 cents.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Ouachita Iron Works Inc., Monroe, La., has discontinued business.

River Brass Foundry, Central Falls, R. I., has discontinued business. Buildings and equipment have been sold.

Ware Foundry Inc., South Bend, Ind., has been incorporated by John H. Ware to operate a foundry and machine shop.

Reliance Iron Works, 1000 South Meridian street, Alhambra, Calif., is building a 60-foot extension to its foundry.

The foundry of the Hayes Pump & Planter Co., Galva, Ill., has resumed operations.

T. L. Smith Co., Milwaukee, has become affiliated with the National Equipment Corp., Milwaukee, Wis.

Paul Williams Co., 444-448 Pine street, Macon, Ga., has purchased the assets of the Williams Mfg. Co., Macon.

The name of the Nekoosa Motor & Machine Co., Nekoosa, Wis., has been changed to the Nekoosa Foundry & Machine Works.

Henry Furnace & Foundry Co., Medina, O., has resumed operations after being shut down since Dec. 24. Two cupolas have been rebuilt.

Lamb Knitting Machine Co., Chicopee Falls, Mass., has discontinued business. The entire plant including buildings and all equipment is being sold.

W. K. Henderson Iron Works & Supply Co., 218 Spring street, Shreveport, La., has received a permit for an addition to its foundry.

Davies & Thomas Co., founder and machinist, Catasauqua, Pa., has moved its New York offices to the Lincoln building, 60 East Forty-second street.

Calorizing Co., Wilkinsburg, Pa., has started construction of a foundry unit, 80 x 140 feet. Austin Co., Union Trust building, Pittsburgh, is the builder.

Cadillac Malleable Iron Co., Cadillac, Mich., has resumed operations on a reduced schedule after being closed for some time.

Approximately 250 men returned to work recently at the plant of the Richmond Radiator Co., Uniontown, Pa., after being idle for several months. About 100 more will be added upon completion of the boiler plant which was moved there from Norwich, Conn.

South Seattle Foundry Co., 3901 Ninth avenue south, Seattle, Wash., has awarded contract to the Arnold Construction Co. for two additions, 42 x 45 feet and 21 x 38 feet.

Forest Hill Foundry Co., Newark, N. J., has been incorporated with $100,000 capital by Louis Naparano, Donatella Naparano and Peter A. Leonardis.

Lynchburg Foundry Co., Radford, Va., is increasing the number of employes at that plant. Reports state that the company's outlook for the year is exceptionally good.

Keck-Gonnerman Co., Mt. Vernon, Ind., has been incorporated with $200,000 capital by John and Louis D. Keck and William Gonnerman to operate a foundry, machine and steel shops.

American Brass Novelty Co., Grand Haven, Mich., reports the past year one of the best in its history. The plant has been at practically capacity during the entire year.

Two plants of the Thatcher Furnace Co., Newark, N. J., and two in Garwood, N. J., will be back to 90 per cent of capacity, according to an official announcement.

Griffis Hays Foundries Inc., Galva, Ill., has been incorporated with $50,000 capital by H. E. Anthony, 42 East Losey street, Galesburg, Ill., to engage in a general foundry business.

Jenkins Bros. Ltd., 103 St. Remi street, Montreal, Que., will build a new foundry at Lachine, Que. Work on the new plant will start in the spring. It is planned to have the foundry in operation in the fall.

Mentz Collins Brass Works, 260 North Front street, Memphis, Tenn., recently was organized by C. A. Mentz and O. Collins to operate a jobbing foundry for the production of brass, bronze and aluminum castings.

Irwin Foundry & Mine Car Co., Irwin, Pa., recently has secured contracts which assure full operation until March 1. The company has been operating full time for several months.

Standard Iron Works, 106th avenue and 121st street, Edmonton, Alta., will rebuild that part of its plant which recently was damaged by fire and will purchase new equipment. R. M. Dingwall is manager.

Sharpsburg Foundry Co., Sharpsburg, Pa., has been incorporated with $100,000 capital by Joseph C. Kotoush, 464 North avenue, Millvale, Pa., to manufacture castings, metal products and machinery.

Concrete Steel Products of Canada Ltd., Montreal, Que., has been incorporated by John D. Kearney, 104 Elmer street, to carry on the business of iron master, steel converter, engineer and iron and brass founder.

Lincoln Foundry & Machine Works, Ltd., St. Catherines, Ont., has been incorporated with $40,000 capital by William D. Kier and James G. Schiller to manufacture hydraulic and dipper dredges and dredge equipment.

Duquesne Steel Foundry Co., Philadelphia, has been incorporated with $5,000 capital by James H. Boyd, 1724 Oliver Building, Philadelphia, to manufacture and deal in steel and other metals.

Iroquois Foundry Co., Racine, Wis., which began operations last August, has been enjoying good business. The company is under the direction of R. L. Niess, August Zierthaler, and John Jurax.

Grand Haven Brass Foundry, 230 Hopkins avenue, Grand Haven, Mich., reports that the company began the new year with more business booked than at any similar time since the plant has been organized.

Marion Steam Shovel Co., Marion, O., recently increased the number of hours of the men employed in the steel foundry from 8 to 9½ hours. That advance places the plant on a full time basis.

S. & H. Foundry Co., Mishawaka, Ind., recently organized by August C. Scherrer and Walter A. Hammer, has

begun operations. The company will manufacture aluminum, brass and bronze castings. The initial floor space is 5000 square feet.

Municipal Foundries Inc., Milwaukee, will erect an addition at 652 Seventy-seventh avenue, West Allis, Wis., to be equipped as a dipping and cleaning room. Cost of the project is estimated at $30,000. Leroy Zimmerman is president.

Moulds Brass Foundry, Benton Harbor, Mich., reports that it expects to have the most successful year in its history in 1931. William Moulds is president, H. B. Ross, vice president and Mrs. L. Risto, secretary and treasurer of the company.

Fremont Foundry & Valve Works, 1340 West Fifth Street, Oklahoma City, Okla., advises through R. B. Fremont, president, that the company has been incorporated to expand the manufacture of oil field items. No building increase is planned at present.

Layne & Bowler Inc., Chelsea and May streets, Memphis, Tenn., is adding more molding space to its foundry by rearrangement of equipment. Additional foundry equipment purchased includes a 500-pound furnace for melting metal for brass castings. It is planned to add a core drying oven soon.

Rothe Foundry Co., Green Bay, Wis., has completed one of the largest single castings it ever has produced. It is the keel for a large pleasure yacht under construction by the Burgher Boat Co., Manitowoc, Wis. The keel casting is 33 feet long and weighs 26,000 pounds.

Newbury Mfg. Co., Munroe, N. Y., has acquired the plant formerly operated by the J. & B. Foundry Co., Inc., Talledega, Ala., and plans to transfer all its activities there in the near future. The company manufactures gray iron pipe fittings and has conducted a business in Munroe, N. Y., for the past 30 years.

Fales & Jenks Machine Co., Pawtucket, R. I., has been purchased by the Whitin Machine Works, Whitinsville, Mass., and the foundry has been moved to the main plant at Whitinsville. Woonsocket Machine & Press Co. Inc., Woonsocket, R. I., also has been purchased by the Whitin company and the equipment is being moved to the main plant.

Frank Hamachek Machine Co., Kewaunee, Ill., advises through Frank Hamachek Jr. that preliminary plans are being prepared for a foundry 60 x 80 feet, a 2-story machine shop, 60 x 140 feet, and a central heating plant, to replace a portion of present facilities. Construction will start in the spring. Company manufactures pea viners and pea hulling machinery.

The name of the National Bronze Co. Ltd., St. Laurent, Que., has been discontinued. The National company is a subsidiary of the Robert Mitchell Co., Ltd., 750 Belair avenue, Montreal, Que., and the St. Laurent plant will be known under that name. The Mitchell company is moving its gray iron foundry from the Montreal address to the St. Laurent plant.

Manufacturing facilities of the Norwich, Conn., plant of the Richmond Radiator Co., Uniontown, Pa., have been moved to the Uniontown plant and the Norwich plant will hereafter be used as a warehouse for the Richmond company. The Norwich plant was organized in 1867 as the Richmond Stove Co with a capital of $100,000, with Apollos Richmond, president, G. G. Richmond, secretary and treasurer, and Sampson G. Richmond, agent. The company was reorganized in 1902 as the Richmond Co. After several changes in name and the acquisition of several companies, the company became involved in patent litigation and in March 1912 went into receivership. It was reorganized in September of the same year as the Richmond Radiator Co.

J. B. Beaird Corp., St. Vincent and Shreveport, La., recently purchased the Latex Iron & Steel Works, Shreveport. The Latex plant will be discontinued and dismantled. All equipment is being moved to the Shreveport plant of the Beaird Corp. which is erecting a plant addition, 140 x 300 feet, to house a steel foundry, machine and forge shop. J. B. Beaird is general manager of the Beaird Corp.

Detroit Gray Iron Foundry Co., 3801 Wight street, Detroit, will construct a new $100,000 plant unit. Contract for the steel work on the plant has been awarded to Whitehead & Kales, while the general contract has been let to the C. O. Barton Co., both of Detroit. Equipment will include five, 10-ton traveling cranes. The new addition will bring the total capacity of the plant to 800,000 pounds of castings daily. Hugh Martin is president of the company.

New Trade Publications

MICRO - METALLOGRAPH — E. Leitz Inc., New York, has issued a catalog of its metallographic equipment. Late developments in this class of equipment for studying metals are included.

V-BELT DRIVES—Bulletin L-400 has been issued by the Worthington Pump & Machinery Corp., New York, giving illustrations of typical uses and engineering data on the multi-V-drive sold by the company.

ELECTRICAL EQUIPMENT—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued its general catalog for 1931-1932, covering its entire line. An instant index has been included to aid immediate reference to any section.

INDUSTRIAL PLANTS—The Austin Co., Cleveland, has prepared a booklet for distribution among prospective builders, citing questions to be considered before starting construction. Answers are provided from the experience of the company.

CONVEYOR OVENS—Bulletin No. 11 from the Despatch Oven Co., 622 Ninth street, Southeast, Minneapolis, describes and illustrates typical installations of continuous conveyor ovens for various baking and drying processes.

PICKLING EQUIPMENT—Weaver Bros. Co., Adrian, Mich., has issued a catalog of its pickling supplies and equipment for use in metal departments. It covers the history of the company and its facilities and a section is devoted to the technique of pickling.

MATERIALS HANDLING—Reduction of expense of handling materials and products is stressed in a bulletin by the Lewis-Shepard Co., Watertown station, Boston. The bulletin shows the use of jacklifts, stackers and steel frame platforms in various industrial plants.

GEARS—A 96-page catalog from the Ohio Gear Co., 1333 East 179th street, Cleveland, is arranged to give complete information on the wide range of stock gears carried by the company. Formulas and information of value to the engineer are included for the design and adaptation of gearing and reduction units.

TRAMRAIL—Buckets are indicated as an efficient means for handling bulk materials and the tramrail is suggested as an excellent means of handling the buckets, in a bulletin by the Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O. Illustrations show a variety of handling problems solved by the tramrail.

METAL CLEANING — Mangus Chemical Co., Garwood, N. J., has issued a 76-page book on the cleaning of metal, describing processes, methods, and materials with practical suggestions for their use. Products made by the company and the services it offers are covered along with general information of value to the user of cleaning processes.

WROUGHT IRON—A bulletin on characteristics and application of wrought iron is being circulated by the Wrought Iron Research association, Pittsburgh. It gives pictorial and textual information on wrought iron, with microphotographic illustrations, showing structure of the metal, and charts and tables covering its physical properties.

GRINDING WHEELS—Norton Co., Worcester, Mass., has issued a booklet titled, "A New Method of Marking Grinding Wheels." Detailed explanation of the marking of the company's products is given. A section of the booklet is devoted to an explanation of the meaning of controlled structure in the manufacture of grinding wheels. Illustrations of wheel structure are presented.

ELECTRICAL EQUIPMENT—General Electric Co., Schenectady, N. Y. has issued a series of illustrated bulletins on products made by the company. The following are included: Hand starting compensators, automatic, full-voltage controllers for synchronous motors, magnetic switches, automatic switchgear, enclosed, fan-cooled induction motors, resistor arc welders, and oil circuit breakers.

VARIABLE TRANSMISSION —Link-Belt Co., Chicago, has issued a publication, No. 1274, which describes the new, variable speed transmission made by that company. Illustrations and drawings show the general features of design and construction used to provide a positive, infinitely variable, transmission. Speeds and horsepower output for the various models are listed in a data table.